Building 250 Ellsworth Expansion

Initial Air License Application

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The Jackson Laboratory
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1. INTRODUCTION

1.1 Facility Description

Located at 600 Main Street, The Jackson Laboratory (JAX) is an independent, nonprofit biomedical mammalian research institution and National Cancer Institute-designated Cancer Center. Its mission is to discover precise genomic solutions for disease and empower the global biomedical community in the shared quest to improve human health. Its research staff of more than 200 Ph.D.s and M.D.s investigates the genetic basis of cancers, heart disease, osteoporosis, Alzheimer's disease, glaucoma, diabetes and many other human diseases and disorders, as well as normal development, reproduction, and aging. JAX is also the world's source for more than 7,000 strains of genetically defined mice, is home of the mouse genome database, and is an international hub for scientific courses, conferences, training, and education.

JAX's main campus is situated on a 43-acre facility in Bar Harbor with 47 buildings. JAX owns a total of 67 buildings on 160 acres adjacent to or near the main campus. JAX is proposing to expand their operations to the property at 21 Kingsland Crossing in Ellsworth, Maine, commonly referred to as the former Lowe's Building. JAX acquired the Lowe's Building in 2012 and has been using it for warehouse space since then. JAX intends to build out the facility as a mouse production operation that will supplement and expand their current capacity at the Bar Harbor facility. The Ellsworth facility will create a new level of high barrier vivaria with an ultimate goal of providing the highest health status, most characterized and genetically stable, pathogen free mouse models to the worldwide biomedical community.

The plan for this project is to develop the JAX-Ellsworth facility over several years as demand for the mouse genetics models dictates. The phase currently proposed will renovate approximately 80,000 square feet (SF) of the existing structure to provide materials processing, animal production, administrative office, mechanical support, and circulation spaces. In addition, JAX will convert the new 32,000 SF building addition into a central utility plant to support the mouse production, including boilers, generators, and chillers. This phase of the expansion project is planned to open for operation by December 2017.

1.2 Title, Right, and Interest

The Jackson Laboratory parcel is located at 21 Kingsland Crossing, which is Map 16, Lot 2 in the City of Ellsworth. The deed documenting the JAX's title to the parcel is included in **Appendix K**. No purchase and sales agreements are required for this project, as the applicant owns the property.

1.3 Application Contents

A summary of the proposed equipment, associated facility-wide emission levels, and regulatory classification is provided in Section 2. Section 3 contains a review of applicable State and Federal regulations. Section 4 contains the required Best Available Control Technology (BACT). Section 5 includes a discussion of ambient air quality modeling requirement.

The required Chapter 115 license application form is included in **Appendix A**. **Appendix B** and **Appendix C** contain the cover letter to the application sent to the City of Ellsworth and the Public Notice of Intent to File published in the January 26, 2017 edition of the Ellsworth American. **Appendix D** contains a site location plan and facility diagram. **Appendix E** contains emission calculations. **Appendices F-J** include equipment specification sheets, and **Appendix K** contains the property deed.

2. PROJECT DETAILS

2.1 Equipment Description

The JAX-Ellsworth facility will have three boilers, two emergency generators, redundant propane vaporizers, and an ethylene oxide (EtO) sterilization unit that will operate in support of the mice production facility as summarized in Table 2-1 and Table 2-2. A description of the emission sources is provided in the following sections.

Table 2-1: Fuel Burning Equipment

Equipment	Maximum Capacity [MMBtu/hr]	Maximum Firing Rate	Fuel Type, %s	Stack #
Boiler 1	25	169 gal/hr, 9,326 SCFH	#2 Fuel Oil, 0.0015%s Propane, neg. %s	B1
Boiler 2	25	169 gal/hr, 9,326 SCFH	#2 Fuel Oil, 0.0015%s Propane, neg. %s	B2
Boiler 3	8	48.7 gal/hr, 3,100 SCFH	#2 Fuel Oil, 0.0015%s Propane, neg. %s	B3
Vaporizer 1	1.4	15 gal/hr	Propane, neg. %s	N/A
Vaporizer 2	1.4	15 gal/hr	Propane, neg. %s	N/A
Generator 1	12.6	90.5 gal/hr	ULSD, <0.0015%s	G1
Generator 2	12.6	90.5 gal/hr	ULSD, <0.0015%s	G2

Table 2-2: Miscellaneous Equipment

Equipment	Pollution Control Equipment
Ethylene Oxide Sterilization Unit	Abator

2.1.1 Boiler Description

The JAX-Ellsworth facility is proposing to install three Cleaver Brooks boilers to support the facility. The boiler room will consist of two FLX200-2500 steam boilers rated at 25.0 MMBtu/hr and one FLX200-800 steam boiler rated at 8.0 MMBtu/hr. All three boilers are capable of firing propane gas or ultra-low-sulfur fuel oil. Boiler specification sheets are provided in **Appendix F**.

The boilers will be equipped with a state of the art parallel positioning control system that uses dedicated actuators for the fuel and air valves, allowing the boilers to operate at lower excess air levels, resulting in an increased overall efficiency. In addition, the boilers are equipped with an oxygen (O_2) trim system that monitors the O_2 content in the exhaust gas and automatically "trims" the fuel valve or air damper to optimize the air-to-fuel ratio.

The two large boilers are equipped with a flue gas recirculation (FGR) system that reduces nitrogen oxide (NOx) emissions by pulling relatively cool combustion gases from the exhaust and mixing with combustion air. The flue gas reduces the heat in the combustion process and lowers the flame temperatures, thereby reducing the thermal NOx production. JAX has selected the lowest emissions model available that will fit within the facility's boiler room and is capable of duel fuel operation.

2.1.2 Vaporizer Description

The propane used in the three boilers is delivered to the Ellsworth facility and stored as a liquid that must be vaporized prior to use in the units. Two redundant direct-fired liquid propane gas vaporizers will be installed for this purpose. Operating on temperature control, the vaporizers function only as-needed to create enough vapor to replace that being used. A small portion of the vapor supplied to the boilers is used to supply the vaporizer burners, each rated at 1.4 MMBtu/hr and capable of producing 91.69 MMBtu/hr of propane gas. The vaporizer units will be Ransome Manufacturing, model RH1000, or similar. Vaporizer specifications are provided in **Appendix J**.

2.1.3 Generator Description

The JAX-Ellsworth facility is proposing to install two 1250 kW Cummins DQGAA diesel generators to provide back-up power to the facility in case of emergencies. The engines are EPA certified for stationary emergency application at Tier 2 emission levels. The generators will be installed within the building, in the Generator Room. The generator specification sheets are provided in **Appendix G**.

2.1.4 Sterilizer Description

The 3M™ Steri-VAC GS5X EtO sterilizer has a sterilization chamber volume of 4.8 cubic feet (CF). The Steri-VAC system uses sealed EtO cartridges that are only punctured once the cartridge is inside the locked, negative pressure sterilization chamber, minimizing the potential for EtO leaks. The EtO cartridges are single-use and contain 127 grams of EtO (0.37 pounds) each. A safety data sheet for the EtO cartridges is provided in **Appendix H**. Emissions of EtO from the sterilization unit is controlled by an abator. The 3M™ EtO Abator Model 50AN converts the EtO exhausted from the sterilization unit into carbon dioxide (CO_2) and water vapor. The exothermic reaction occurs in the presence of a proprietary catalyst with a lifetime of 930 batches. The Model 50AN Abator is capable of achieving an EtO destruction efficiency of 99.9%. A complete description of the Steri-VAC GS5X sterilization unit and the EtO Abator Model 50AN are provided in **Appendix H**.

2.1.5 Fuel Oil Tanks Description

The JAX-Ellsworth facility will have two underground storage tanks (UST), each with a 40,000-gallon capacity. One tank will store ULSD for use in the boilers and emergency generators. The other tank will store liquefied propane gas (LPG) for use in the boilers. Tank specifications are provided in **Appendix I**.

2.2 Application Classification

New sources of air pollutants are considered "Major Sources" or "Minor Sources" based on whether annual emissions from the facility exceed major source thresholds. As summarized below in Table 2-3, the potential-to-emit (PTE) from the facility will remain below all major source thresholds; thus, the JAX-Ellsworth facility is a new minor source.

Table 2-3 Source Classification

Pollutant	Facility PTE [TPY]	Major Source Threshold [TPY]	Source Classification
$PM/PM_{10}/PM_{2.5}$	7.3	100	Minor
SO_2	0.4	100	Minor
NOx	36.8	100	Minor
CO	22.9	100	Minor
VOC	4.8	50	Minor
CO_2e	42,486	75,000	Minor
Single HAP	<1	10	Minor
Total HAP	<1	25	Minor

The facility has the potential to emit over 25 TPY of NOx, thus the facility is required to submit criteria air pollutant emission statements by May 1st covering the previous calendar year period. The report must be submitted electronically through the Maine Air Inventory Reporting System (MAIRIS). Complete emission calculations are included in **Appendix E**.

3. REGULATORY REVIEW

3.1 Boilers and Vaporizers

The boilers are subject to both Federal and State air regulations. The associated propane vaporizers are exempt from Federal air regulations due to their size, fuel type, and classification as process heaters. Provided in the following sections is a summary of the applicable regulations.

3.1.1 Federal Air Regulations

The proposed boilers are subject to two Federal Environmental Protection Agency (EPA) Clean Air Act regulations. The applicability determinations, associated requirements, and proposed compliance demonstrations are summarized below.

40 CFR Part 63 Subpart JJJJJJ – NESHAP for Industrial, Commercial, and Institutional Boilers Area Sources

Boilers located at area sources of hazardous air pollutants (HAPs) are subject to *40 CFR Part 63, Subpart JJJJJJ National Emission Standards for Hazardous Air Pollutants (NESHAP) for Industrial, Commercial, and Institutional Boilers Area Sources*. The three proposed boilers are considered new oil fired boilers with O_2 trim systems.

Emission Limits, Work Practice Standards, and Operating Limits

The two 25 MMBtu/hr boilers are exempt from the applicable emission limit established in Table 1 of Subpart JJJJJJ per §63.11210(f) because the units will combust only ultra-low-sulfur liquid fuel and propane gas. Pursuant to §63.11201 and Table 2 of Subpart JJJJJJ, the boiler's startup and shutdown periods must be minimized and conducted according to the manufacturer's recommended procedures. All three boilers are subject to five-year tune-up requirements per Table 2, due to their size or the use of an O_2 trim system. The tune-up must consist of the following:

- Inspect the burner, and clean or replace any components of the burner as necessary;
- Inspect the flame pattern and adjust the burner as necessary to optimize the flame pattern. The adjustment should be consistent with the manufacturer's specifications, if available;
- Inspect the system controlling the air-to-fuel ratio and ensure that it is correctly calibrated and functioning properly;
- Optimize total emissions of carbon monoxide (CO). This optimization should be consistent with the manufacturer's specifications, if available, and with any nitrogen oxide (NOx) requirement to which the unit is subject;
- Measure the concentrations in the effluent stream of CO in parts per million, by volume (ppmv), and oxygen in volume percent, before and after the adjustments are made (measurements may be either on a dry or wet basis, as long as it is the same basis before and after the adjustments are made). Measurements may be taken using a portable CO analyzer.

A tune-up report must be maintained on site containing the following information:

- The concentrations of CO in the effluent stream in ppmv and oxygen in volume percent, measured at high fire or typical operating load, before and after the tune-up of the boiler;
- A description of any corrective actions taken as a part of the tune-up of the boiler; and

- The type and amount of fuel used over the 12 months prior to the tune-up of the boiler.

General Requirements

The three boilers must be operated in a manner consistent with safety and good air pollution control practices for minimizing emissions per §63.11205(a).

Notifications and Reporting Requirements

JAX must submit an Initial Notification to EPA within 120 days of startup per §63.11225(a)(2). By March 1st each year, JAX must generate a Compliance Report that includes the following:

- Company name and address;
- Statement by a responsible official, with the official's name, title, phone number, email address, and signature, certifying the truth, accuracy and completeness of the report and a statement of whether the source has complied with all the relevant standards and other requirements of this subpart. The report must include the following certification(s) of compliance, as applicable, and signed by a responsible official:
    - "This facility complies with the requirements in §63.11223 to conduct a five-year tune-up of each boiler."
    - "No secondary materials that are solid waste were combusted in any affected unit."
    - "This facility complies with the requirement in §§63.11214(d) and 63.11223(g) to minimize the boiler's time spent during startup and shutdown and to conduct startups and shutdowns according to the manufacturer's recommended procedures or procedures specified for a boiler of similar design if manufacturer's recommended procedures are not available."
- If the boilers experienced any deviations from the applicable requirements during the reporting period, the report must include a description of deviations, the time periods during which the deviations occurred, and the corrective actions taken.

If the JAX-Ellsworth facility fails to meet any applicable requirement or obligation including any emission limit, operating limit, or work practice standard, this is considered a deviation. If deviations from the applicable requirements occurred in the preceding calendar year, the Compliance Report must be submitted to EPA by March 15th. Otherwise, the report should be maintained onsite and submitted only if requested.

Recordkeeping Requirements

Per §63.11225(c), JAX must maintain the following records for a period of five years following the date of each recorded action:

- Copies of notifications and reports with supporting compliance documentation;
- Identification of the boilers, the date of tune-ups, procedures followed for tune-ups, and the manufacturer's specifications to which the boilers were tuned;
- Records, on a monthly basis, of the type of fuel combusted in each boiler;

- Records of the occurrence and duration of each malfunction[1] of the boilers, or of the associated air pollution control and monitoring equipment; and

- Records of actions taken during periods of malfunction to minimize emissions in accordance with the general duty to minimize emissions in §63.11205(a), including corrective actions to restore the malfunctioning boiler, air pollution control, or monitoring equipment to its normal or usual manner of operation.

40 CFR Part 60 Subpart Dc - NSPS for Small Industrial-Commercial-Institutional Steam Generating Units

Pollutants from steam generating units constructed after June 9, 1989 that have a rated design input capacity of less than 100 MMBtu/hr and greater than 10 MMBtu/hr are subject to 40 CFR Part 60, Subpart Dc – *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units*. Therefore, Boiler 1 and Boiler 2 are subject.

Emission Limits

Boiler 1 and Boiler 2 are subject to a sulfur dioxide (SO_2) emission limit of 0.50 lb/MMBtu or a limit of 0.5% weight sulfur content in the fuel oil on a 30-day rolling average basis. Both boilers will combust ultra-low-sulfur liquid fuel and will maintain a certification from the fuel supplier to demonstrate compliance with the fuel sulfur content limit in accordance with §60.42c(h)(1).

Reporting and Recordkeeping Requirements

JAX must provide EPA with a Notification of Construction postmarked within 30 days after construction has commenced and Notification of Initial Startup within 15 days of boiler startup. Both notifications must include the following:

- The design heat input capacity of the boilers and identification of fuels to be combusted in the units;

- The annual capacity factor at which the owner or operator anticipates operating the affected facility based on all fuels fired and based on each individual fuel fired. The annual capacity factor is defined as the ratio between the actual heat input into each boiler on a 12-month basis and the maximum potential 12-month heat input assuming 8,760 hours of operation at maximum design capacity.

JAX must submit semiannual reports that must include the following per §60.48c(e):

- Calendar dates covered in the reporting period;

- Each 30-day average sulfur content (weight percent) calculated during the reporting period, ending with the last 30-day period;

- Reasons for any noncompliance with the emission standards and a description of corrective actions taken; and

[1] Malfunction as defined in §63.2 means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes, or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

- Records of fuel supplier certification and a certified statement signed by the owner or operator of the affected facility that the records of fuel supplier certifications submitted represent all of the fuel combusted during the reporting period. The fuel supplier certification shall include the following information:
    - The name of the oil supplier;
    - A statement from the oil supplier that the oil complies with the specifications under the definition of distillate oil in §60.41c; and
    - The sulfur content or maximum sulfur content of the oil.

Per §60.48c(g)(2), JAX must maintain records of the amount of each fuel combusted during each calendar month in each subject boiler.

3.1.2 Maine Department of Environmental Protection Regulations

The proposed boilers and vaporizer units will be subject to unit specific particulate matter and visible emission limits established in Maine DEP regulation 06-096 Chapters 103 and 101 and a fuel sulfur content limit established in Chapter 106.

06-096 CMR 101 Visible Emission Regulation

Chapter 101 establishes opacity limits from various emission sources. This regulation is currently under revision; the determinations included herein are based on the latest revision of regulation.

Boiler 1, Boiler 2, and Boiler 3 are subject to an opacity limit of 20% on a six-minute block average basis when firing fuel oil. When firing propane, the visible emissions are limited to an opacity of 10% on a six-minute block average basis. In addition, the two propane vaporizers will comply with the propane visible emission limit of 10% on a six-minute block average basis.

06-096 Chapter 103: Fuel Burning Equipment Particulate Emission Standard

Chapter 103 applies to all fuel burning or solid waste fuel burning equipment having a rated capacity of 3 MMBtu/hr or greater. The proposed boilers are subject to the 0.12 lb/MMBtu particulate matter (PM) emission limit established in 06-096 CMR 103 (2)(B)(1)(a) as they have a heat input capacity less than 50 MMBtu/hr; however, the boilers will meet a lower PM limit as BACT. Testing to demonstrate compliance with this limit will only be completed if requested by Maine DEP.

06-096 Chapter 106: Low-Sulfur Fuel

Chapter 106 establishes sulfur content limits for various liquid fossil fuels. Sources consuming distillate fuel oil must comply with a distillate fuel sulfur content limit of 0.0015% by weight beginning July 1, 2018.

3.2 Generators

3.2.1 Federal Air Regulations

The proposed emergency generators are subject to two Federal Environmental Protection Agency (EPA) Clean Air Act regulations. The applicability determinations, associated requirements, and proposed compliance demonstrations are summarized below.

40 CFR Part 63 Subpart ZZZZ – NESHAP for Stationary Reciprocating Internal Combustion Engines

Pollutants from stationary engines at major and area sources of HAPS are regulated under 40 CFR Part 63 Subpart ZZZZ – *National Emission Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines (RICE)*. JAX-Ellsworth has the potential to emit less than 10 tons per year of a single HAP and less than 25 tons per year of aggregate HAPs; therefore, the facility is defined as an "area source".

The proposed emergency generators will be installed in 2017. Per 40 CFR § 63.6590(a)(2)(iii), the proposed emergency generators will be considered "new stationary RICE located at an area source" because they were constructed after June 12, 2006 and the JAX-Ellsworth site qualifies as an area source of HAPs. Pursuant to 40 CFR § 63.6590(c)(1), units classified under this category meet their obligations under the RICE NESHAP regulation by complying with EPA's New Source Performance Standards (NSPS) requirements under 40 CFR Part 60, Subpart IIII. No additional requirements of the RICE NESHAP regulation apply to the proposed emergency generators.

40 CFR Part 60 Subpart IIII – NSPS for Stationary Compression Ignition Internal Combustion Engines

Stationary compression ignition engines that meet the definition of "new" under the RICE NESHAP are regulated under 40 CFR Part 60 Subpart IIII – *New Source Performance Standards (NSPS) for Stationary Compression Ignition (CI) Internal Combustion Engines (ICE)*. The proposed generators are subject to the NSPS requirements applicable to emergency engines.

Operating Purposes Restrictions

Pursuant to 40 CFR §§ 60.4211(f)(2)(i), the proposed emergency generators may operate only to provide electrical power during an emergency situation, maintenance checks and readiness testing as recommended by the manufacturer (or certain other parties), emergency demand response, and 50 hours per year of non-emergency situations. As noted below, operation for non-emergency purposes is limited to 100 hours per year.

Emission Standards

Pursuant to 40 CFR §§ 60.4205(b) and 60.4202(a)(2), owners and operators of 2007 model year or later emergency stationary compression ignition internal combustion engines (CI ICE) with a displacement of less than 10 liters per cylinder must comply with EPA's emission standards for non-road engines. Based on the proposed emergency generators model year and rated power, the engines are required to meet EPA's Tier 2 emissions standards. A Certificate of Conformance with the applicable emission standards (Certificate Number HCPXL78.1NZS-016) is provided in **Appendix G**.

Fuel Requirements

Pursuant to 40 CFR § 60.4207(b), the proposed emergency generators must use diesel fuel that meets EPA's requirements for non-road diesel fuel under 40 CFR § 80.510(b). Specifically, the diesel fuel must comply with the following standards:

- Maximum sulfur content of 15 ppm; and
- Either a minimum cetane index of 40 ***or*** a maximum aromatic content of 35% by volume.

The compliance with the cetane index or aromatic content requirements will be demonstrated by purchasing non-road, locomotive, and marine (NRLM) diesel fuel.

Monitoring Requirements

Pursuant 40 CFR § 60.4209(a), owners and operators of emergency stationary CI ICE must install a non-resettable hour meter prior to startup of the engines. The proposed emergency generators will be equipped with non-resettable hour meters.

Required Work Practices

Pursuant to 40 CFR §§ 60.4206 and 60.4211, JAX is required to follow the work practices summarized below pertaining to the installation and operation of the proposed emergency generators:

- The emergency generators shall be installed, configured, operated and maintained to achieve required emissions standards certified by the manufacturer over the entire life of the diesel engine;
- The facility may change the specific emission-related settings of the generator units only if and as permitted by the manufacturer;
- If the facility does not install, configure, operate and maintain the emergency generators according to the manufacturer's emission-related written instructions, or changes emission-related settings in a way that is not permitted by the manufacturer, compliance with NSPS Subpart IIII must be demonstrated by conducting stack testing and performing additional work practices.

Operational Requirements

Emergency stationary CI ICE are not subject to an operational time limit for use in emergency situations. Pursuant to 40 CFR § 60.4211(f), non-emergency operation must be limited to 100 hours per year. Non-emergency operation includes the following:

1. Emergency stationary RICE may be operated for maintenance checks and readiness testing, provided that the tests are recommended by federal, state, or local government, the manufacturer, the vendor, the regional transmission organization or equivalent balancing authority and transmission operator, or the insurance company associated with the engine.
2. Emergency stationary RICE may be operated for up to 50 hours per calendar year in other non-emergency situations as described in §60.4211(f)(3). The 50 hours per year of this other non-emergency operation are counted as part of the 100 hours per year limit.

Recordkeeping Requirements (40 CFR 60.4214(b))

Pursuant to 40 CFR § 60.4214(b), JAX is required to keep records of the operation of the generators in emergency and non-emergency service as recorded through its non-resettable hour meter. These records must indicate the time of operation and the reason the engines were in operation during that time.

3.2.2 Maine Department of Environmental Protection Regulations

The proposed emergency generators will be subject to unit specific particulate matter and visible emission limits established in Maine DEP regulation 06-096 Chapters 103 and 101 and a fuel sulfur content limit established in Chapter 106.

06-096 CMR 101 Visible Emission Regulation

Chapter 101 establishes opacity limits from various emission sources. This regulation is currently under revision; the determinations included herein are based on the latest revision of regulation.

Stationary internal combustion engines are subject to an opacity limit of 20 percent on a six-minute block average basis as established in 06-096 CMR 101(A)(4) .

06-096 Chapter 103: Fuel Burning Equipment Particulate Emission Standard

Chapter 103 applies to all fuel burning or solid waste fuel burning equipment having a rated capacity of 3 MMBtu/hr or greater. The proposed emergency generators are subject to the 0.12 lb/MMBtu particulate matter (PM) emission limit established in 06-096 CMR 103 (2)(B)(1)(a) as it has a heat input capacity of 19 MMBtu/hr (less than 50 MMBtu/hr) and fires distillate fuel oil.

06-096 Chapter 106: Low-Sulfur Fuel

Chapter 106 establishes sulfur content limits for various liquid fossil fuels. Sources consuming distillate fuel oil must comply with a distillate fuel sulfur content limit of 0.0015% by weight beginning July 1, 2018. This is consistent with the fuel requirements established in 40 CFR 60 Subpart IIII.

3.3 Sterilization Unit

Ethylene oxide sterilization units are regulated by two Federal Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations. The applicability of each regulation is summarized below.

40 CFR Subpart WWWWW—National Emission Standards for Hospital Ethylene Oxide Sterilizers

Hospitals that are area sources of hazardous air pollutants (HAPs) are subject to Subpart WWWWW – *National Emission Standards for Hospital Ethylene Oxide Sterilizers*. Hospitals are defined in Subpart WWWWW as facilities that provide medical care and treatment for patients under supervision of licensed physicians and under nursing care. JAX does not provide any treatment; thus, it does not meet the definition of a hospital and is not subject to this subpart.

40 CFR Part 63 Subpart O—Ethylene Oxide Emissions Standards for Sterilization Facilities

All sterilization facilities that use 1 ton or more of ethylene oxide during any consecutive 12-month period in sterilization or fumigation operations are subject to Subpart O—Ethylene Oxide Emissions Standards for Sterilization Facilities. JAX has the potential to use less than 1.0 tons per year of ethylene oxide and is further exempt from this regulation as it is a research or laboratory facility as defined in Section 112(c)(7) of the Clean Air Act Amendment of 1990.

3.4 Fuel Oil Tanks

The JAX-Ellsworth facility will have two 40,000-gallon underground storage tanks, one that stores ULSD and one that stores LPG. The LPG tank will operate under pressure (220-320 psi) in order to maintain the propane as a liquid. The ULSD has a maximum true vapor pressure of approximately 0.15 kilopascals (kPa).

40 CFR 60 Subpart Kb—Standards of Performance for Volatile Organic Liquid Storage Vessels

Tanks greater than 75 cubic meters (~20,000 gallons) for which construction, reconstruction, or modification commenced after July 23, 1984 and that store volatile organic liquids (VOL) are subject to Subpart Kb. However, there is an exemption for tanks that store 151 cubic meters (~40,000 gallon) or more of a liquid with a maximum true vapor pressure less than 3.5 kPa.

The maximum true vapor pressure is defined as the equilibrium partial pressure exerted by the VOCs in the VOL at the local maximum monthly average temperature as reported by the National Weather Service. The maximum monthly average temperature for the Ellsworth area is about 75^{o} F. Therefore, the maximum true vapor pressure is the vapor pressure of ULSD at 75^{o} F. According to the Safety Data Sheet (SDS) provided by the potential ULSD supplier, the vapor pressure at 68^{o} F is 1 mm Hg (0.13 kPa). Using the Ideal Gas Law, this equates to 0.15 kPa at 75^{o} F, which is well below the exemption threshold established in Subpart Kb; thus, this regulation does not apply to the ULSD tank.

Similarly, there is an exemption in §60.110b(d)(2) for pressure vessels designed to operate in excess of 204.9 kPa and without emissions to the atmosphere. The LPG tank will operate at a pressure of 220-320 psi (1500-2200 kPa); thus, this tank is also exempt from Subpart Kb.

06-096 Chapter 111: Petroleum Liquid Storage Vapor Control

Chapter 111 applies to all fixed roof storage vessels with capacities greater than 150,000 liters (39,000 gallons) containing volatile petroleum liquids whose maximum true vapor pressure is greater than 10.5 kPa (1.52 psia). As discussed above, the maximum true vapor pressure of ULSD is 0.15 kPa thus is regulation does not apply to the ULSD tank.

The LPG tank is operated under pressure to maintain the propane in its liquid state. Because the tank is under pressure, no vapor emissions are expected to occur. Further, at normal atmospheric pressures, the propane would be in its gaseous state. This regulation applies only to volatile petroleum liquid tanks.

4. BEST AVAILABILE CONTROL TECHNOLOGY

The JAX-Ellsworth expansion project and associated pollution sources represent a Minor New Source under Maine DEP Chapter 115 regulations. As such, JAX must demonstrate that the emission units associated with the new project will receive BACT as defined in Maine DEP Chapter 100 regulations. See Maine DEP Regulation Chapter 115 § 4(A)(4)(d). BACT is defined as:

> An emission limitation (including a visible emissions standard) based on the maximum degree of reduction for each pollutant emitted from or which results from the new or modified emissions unit which the Department on a case by case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such emissions unit through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combination techniques for control of each pollutant. In no event shall application of BACT result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Part 60 and 61 or any applicable emission standard established by the Department. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results. (Maine DEP Regulation Chapter 100 § 18)

The proposed boilers, vaporizers, emergency generators, and sterilization unit have the potential to emit the following criteria air pollutants: volatile organic compounds (VOCs), particulate matter ($PM/PM_{10}/PM_{2.5}$), nitrous oxides (NOx), carbon monoxide (CO), and sulfur dioxide (SO_2). The following BACT analysis for the stated criteria air pollutants has been prepared in accordance with Maine DEP regulations and the Northeast States for Coordinated Air Use Management (NESCAUM) BACT Guideline. There are five key steps in the BACT Procedure:

1. Identify all control technologies applicable to the process;
2. Eliminate technically infeasible options;
3. Rank remaining control technologies by control effectiveness;
4. Evaluate technically feasible control alternatives (energy, environmental, and economic impacts) if a control technology less effective than the top option is proposed as BACT; and
5. Select BACT in consideration of energy, environmental, and economic impacts.

4.1 Control of Air Pollutants from the Boilers

As part of the Ellsworth expansion project, JAX is proposing to install three dual-fuel boilers capable of firing propane gas and ultra-low-sulfur diesel. Boiler #1 and Boiler #2 are rated at 25 MMBtu/hr, and Boiler #3 is rated at 8 MMBtu/hr. The boilers are equipped with oxygen trim systems, parallel positioning control systems, and flue gas recirculation. The following BACT analysis for Boilers 1-3 has been prepared in accordance with the Northeast States for Coordinated Air Use Management (NESCAUM) BACT Guideline summarized above.

4.1.1 Control of Nitrogen Oxide Emissions

Nitrogen oxides (NOx) are a product of combustion in the boiler. NOx is generated in one of three mechanisms; fuel NOx, thermal NOx, and prompt NOx. Fuel NOx is produced by oxidation of nitrogen in the fuel source. Combustion of fuels with high nitrogen content produces greater amounts of NOx than those with low nitrogen content. Thermal NOx is formed by the fixation of nitrogen (N_2) and oxygen (O_2) at temperatures greater than 2900°F. Prompt NOx forms from the oxidation of hydrocarbon radicals near the combustion flame and produces an insignificant amount of NOx.

There are two ways to reduce NOx emissions: good combustion design/practices and add-on pollution control. A summary of the potential NOx control options is summarized in Table 4-1.

Table 4-1 NOx Emission Control Options for Boilers

Control Technology	% Control	Feasibility
Selective Catalytic Reduction (SCR)	70-90%	Technically feasible but cost prohibitive
Selective Non-Catalytic Reduction (SNCR)	30-75%	Technically feasible but cost prohibitive
Water/Steam Injection	<80%	Technically infeasible
Flue Gas Recirculation	<80%	**SELECTED**
Oxygen Trim System	VARIABLE	**SELECTED**
Good Combustion Practices	VARIABLE	**SELECTED**

Add-On Pollution Control Options

Potential add-on pollution control options for control NOx emissions from boilers includes selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), and water/steam injection. Water/steam injection is the process of injecting water or steam into the combustion chamber to act as a thermal ballast in the combustion process. The ballast lowers the combustion temperature, minimizing thermal formation of NOx. Water/steam injection can reduce NOx emissions at a rate equivalent to flue gas recirculate (FGR) but results in reduced boiler efficiency of 5%. Since FGR is incorporated into the boiler design, water/steam injection will not be evaluated further.

SCR systems employs the reaction of NOx with ammonia in the presence of a catalyst to project nitrogen and water. The SNCR process is a method of post combustion control that selectively reduces NOx into nitrogen and water vapor by reacting the exhaust gas with a reagent such as ammonia or urea, similar to the SCR system. However, the use of a catalyst is negated when the chemical reaction takes place at temperatures ranging between 1600 and 2100^{o}F.

Both SCR and SNCR are technically feasible control technologies for minimizing NOx emissions from boilers but are generally only installed on large combustion units. The EPA Air Pollution Control Technology Fact Sheets for both SCR (EPA-452/F-03-032) and SNCR (EPA-452/F-03-031) states that this pollution control technology is only cost effective for units over 50 MMBtu/hr. Due to the initial capital cost and annual operating costs plus the potential environmental issues surrounding unreacted ammonia slip, both of these technologies are not feasible for boilers of this size.

Boiler Design Options

The large boiler designs will incorporate flue gas recirculation (FGR) to reduce the temperature of combustion, in turn reducing thermal NOx formation. In combination with the oxygen trim system, the recirculated flue gas lowers the average oxygen concentration in the combustion zone, which lowers the oxygen available to react with nitrogen to form NOx. The use of FGR on the large boilers and an oxygen trim system will allow the boilers to achieve the following NOx emissions rates:

- Boiler #1 & Boiler #2: 0.11 lb/MMBtu and 2.75 lb/hr when firing fuel oil; 0.05 lb/MMBtu and 1.25 lb/hr when firing propane; and
- Boiler #3: 0.20 lb/MMBtu and 1.60 lb/hr when firing fuel oil; 0.053 lb/MMBtu and 0.42 lb/hr when firing propane.

Based on maximum operation, Boiler #1 and Boiler #2 each have the potential to emit 12.0 TPY of NOx, and Boiler #3 has the potential to emit 7.0 TPY of NOx. Therefore, JAX is proposing the use of FGR, oxygen trim system, and good combustion practices as BACT for control of NOx emissions.

4.1.2 Control of Carbon Monoxide and Volatile Organic Compound Emissions

Carbon monoxide (CO) is a colorless, odorless, relatively inert gas formed as an intermediate product of combustion. Volatile organic compounds (VOCs) are also a result of incomplete combustion. CO and VOC emissions result when there is insufficient residence time or if there is insufficient oxygen available near the hydrocarbon molecule during combustion to complete the final step in hydrocarbon oxidation. In addition, combustion modifications taken to reduce NOx emissions may result in increased CO and VOC emissions.

There are two ways to reduce CO and VOC emissions: good combustion design/practices and add-on pollution control. Table 4-2 summarizes the potential CO and VOC control options.

Table 4-2 CO and VOC Emission Control Options for Boilers

Control Technology	% Control	Feasibility
Oxidation Catalyst	98%	Technically feasible but cost prohibitive
Thermal Oxidizer	95%	Technically feasible but cost prohibitive
Oxygen Trim System	VARIABLE	**SELECTED**

Add-On Pollution Control Options

Potential add-on pollution control options for control of CO and VOC emissions include catalytic oxidation and thermal oxidation. Thermal oxidation is the process of completing the oxidation of combustible materials by raising the temperature of the gases above the ignition point in the presence of oxygen and maintaining that temperature for enough time to ensure complete combustion to CO_2 and water. Similarly, catalytic oxidation uses a catalyst to increase the oxidation reaction rates for CO and VOC. Both add-on pollution control options have high capital, maintenance, and operational costs, making them infeasible for installation on boilers of this size.

Boiler Design Options

As discussed above, the boilers will be equipped with a parallel positioning control system that uses dedicated actuators for the fuel and air valves, allowing the boilers to operate at lower excess air levels, resulting in an increased overall efficiency. In addition, the boilers are equipped with an oxygen (O_2) trim system that monitors the O_2 content in the exhaust gas and automatically "trims" the fuel valve or air damper to optimize the air-to-fuel ratio. If insufficient combustion air is available in the combustion chamber, incomplete combustion occurs, resulting in increased CO emissions. An oxygen trim system ensures that adequate combustion air is present for complete combustion. The use of an oxygen trim system and good combustion practices will allow the boilers to achieve the following emission rates:

- Boiler #1 and Boiler #2:
    - CO: 0.036 lb/MMBtu and 0.89 lb/hr when firing fuel oil and 0.082 lb/MMBtu and 2.05 lb/hr when firing propane;
    - VOCs: 0.016 lb/MMBtu and 0.40 lb/hr when firing fuel oil and 0.011 lb/MMBtu and 0.27 lb/hr when firing propane.
- Boiler #3:
    - CO: 0.039 lb/MMBtu and 0.31 lb/hr when firing fuel oil and 0.082 lb/MMBtu and 0.66 lb/hr when firing propane;
    - VOCs: 0.030 lb/MMBtu and 0.24 lb/hr when firing fuel oil and 0.011 lb/MMBtu and 0.09 lb/hr when firing propane.

Based on maximum operation, Boiler #1 and Boiler #2 each have the potential to emit 9.0 TPY of CO and 1.75 TPY of VOCs, and Boiler #3 has the potential to emit 2.9 TPY of CO and 1.0 TPY of VOCs. Therefore, JAX is proposing the use of and oxygen trim system and good combustion practices as BACT for control of CO and VOC emissions.

4.1.3 Control of Particulate Matter Emissions

Particulate matter (PM) emissions from fuel oil combustion are dependent upon the ash content of the oil and the completeness of combustion. The ash content of lighter distillate oils such as ULSD is significantly less than heavier residual oils. PM emissions from propane are generally very low. They can result from soot, aerosols formed by condensable emitted species, or boiler scale dislodged during combustion. Since JAX is proposing to burn only low-ash content fuels and is proposing to optimize combustion using oxygen trim, additional add-on pollution controls are not feasible. By ensuring complete combustion and the use of low-ash fuel, the boilers will achieve the following PM emission rates:

- Boiler #1 and Boiler #2: 0.024 lb/MMBtu and 0.60 lb/hr when firing fuel oil and when firing propane;
- Boiler #3: 0.024 lb/MMBtu and 0.19 lb/hr firing fuel oil and when firing propane;

Based on maximum operations, Boiler #1 and Boiler #2 each have the potential to emit 3.1 TPY of PM/PM_{10}/$PM_{2.5}$ and Boiler #1 has the potential to emit 1.0 TPY of PM/PM_{10}/$PM_{2.5}$. Thus, JAX is proposing use of inherently low-sulfur fuels as BACT for PM.

4.1.4 Control of Sulfur Dioxide Emissions

Sulfur dioxide (SO_2) emissions from combustion are directly proportional to the amount of sulfur inherent in the fuel. In the three boilers, JAX is proposing to use ultra-low-sulfur diesel and propane gas, both of which have minimal sulfur content. Additional add-on technologies to further control SO_2 emissions are not feasible. The use of low-sulfur fuels will allow the boilers to achieve the following SO_2 emission rates:

- Boiler #1 and Boiler #2: 0.002 lb/MMBtu and 0.04 lb/hr when firing fuel oil and 0.001 lb/MMBtu and 0.03 lb/hr when firing propane;
- Boiler #3: 0.002 lb/MMBtu and 0.01 lb/hr firing fuel oil and 0.001 lb/MMBtu and 0.01 lb/hr when firing propane;

Based on maximum operations, Boiler #1 and Boiler #2 each have the potential to emit 0.17 TPY of SO_2 and Boiler #1 has the potential to emit 0.05 TPY of SO_2. Thus, JAX is proposing use of inherently low-sulfur fuels as BACT for SO_2.

4.2 Control of Air Pollutants from the Vaporizers

As part of the Ellsworth expansion project, JAX is proposing to install two redundant direct-fired liquid propane gas vaporizers. Each vaporizer will have a burner rated input of 1.4 MMBtu/hr. The following BACT analysis for Vaporizer 1 and Vaporizer 2 has been prepared in accordance with the Northeast States for Coordinated Air Use Management (NESCAUM) BACT Guideline summarized above. The technologies listed in **Table 4-3** are determined to be potentially available control technologies for emissions from propane combustion sources. The technologies are listed by order of effectiveness and described in greater detail in following subsections.

Table 4-3: Potentially Available Control Technologies for Emissions from Vaporizers

Pollutant	Control Technology
PM/PM_{10}	1. *Add-on Pollution Control* 2. *Good Combustion Practices*
SO_2	1. *Add-on Pollution Control* 2. *Low-Sulfur Fuels*
NOx	1. *Selective and Non-Selective Catalytic Reduction* 2. *Clean Fuels* 3. *Good Combustion Practices*
CO and VOCs	1. *Proper Maintenance* 2. *Good Combustion Practices*

4.2.1 Control of Particulate Matter

Particulate matter (PM) from fuel combustion is formed from non-combustible material (ash) in the fuel and from incomplete combustion. Add-on pollution control equipment for the control of PM includes baghouses, scrubber, and electrostatic precipitators. Due to the very small size of the vaporizers, the installation of add-on pollution control equipment is not feasible. Good combustion practices, including operating the vaporizers according to manufacturer's recommendations will minimize the products of incomplete combustion, including PM, during operation. Employing good combustion practices is a technically feasible way to control PM emissions from the vaporizers and is therefore proposed as BACT for the vaporizers.

4.2.2 Control of Sulfur Dioxide

Sulfur dioxide (SO_2) is formed from sulfur in the fuel during combustion. Pollution control options to reduce the emissions of SO_2 can be achieved through either flue gas desulfurization by means of wet scrubbing whereby a caustic solution is used to remove sulfur from the flue gas, or limiting the sulfur content of the fuel. The cost of a wet scrubbing system for the vaporizers, including the associated annual operating cost for caustic, energy, operation and maintenance, does not make this option economically feasible. The vaporizers will utilize propane, an inherently low-sulfur fuel; thus, JAX is proposing the use of propane as BACT for limiting SO_2 emissions from the vaporizers.

4.2.3 Control of Nitrogen Oxides

Nitrogen oxides (NOx) from fuel combustion are generated in one of three mechanisms; fuel NOx, thermal NOx, and prompt NOx. Fuel NOx is a result of the oxidation of fuel-bound nitrogen with oxygen present for combustion. Combustion of fuels with high nitrogen content produces greater amounts of fuel NOx than those with low nitrogen content such as distillate oil and natural gas. Thermal NOx is formed via the dissociation of nitrogen and the reaction

with oxygen from combustion air at temperatures greater than 2900°F. Prompt NOx forms from the oxidation of hydrocarbon radicals near the combustion flame and produces an insignificant amount of NOx.

Potential control technologies for NOx emissions from fuel combustion sources include: 1) add-on controls (Selective Catalytic Reduction and Selective Non-Catalytic Reduction), 2) combustion of clean fuels, and 3) good combustion practices.

Add-on Controls – Add-on pollution control technology for the reduction of NOx includes selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR), which are primarily used on large industrial and utility boilers. The installation of these pollution control technologies on these low heat input capacity units is not economically feasible.

Combustion of Clean Fuels – The combustion of clean fuels to minimize NOx emissions is accomplished by burning fuels with less fuel bound nitrogen.

Good Combustion Practices – The fuel combustion sources are operated and maintained so as to limit the formation of thermal NOx.

Because add-on control technology is not a feasible option for control of NOx emissions from the two vaporizers, JAX is proposing to employ good combustion practices and the combustion of a clean burning fuel as BACT for control of NOx emissions from the vaporizers.

4.2.4 Control of Carbon Monoxide and Volatile Organic Compounds

Carbon monoxide (CO) and volatile organic compound (VOC) emissions result from incomplete combustion of fuels. CO and VOC emissions result when there is insufficient residence time or oxygen available near the hydrocarbon molecule during combustion to complete the final step in hydrocarbon oxidation.

To control VOC and CO emissions from small combustion units, no auxiliary equipment is needed. Properly maintaining the units will keep VOC and CO emissions at a minimum. Proper maintenance includes keeping the air/fuel ratio at the manufacturer's specified setting, and having the proper air and fuel pressures at the burners. JAX is proposing to employ proper maintenance to minimize emissions of CO and VOCs as BACT for the two vaporizers.

4.2.5 Vaporizer BACT Summary

JAX is proposing to control emissions of PM, SO_2, NOx, CO, and VOC from Vaporizer 1 and Vaporizer 2 by employing good combustion and maintenance practices, including operating both vaporizers in accordance with manufacturer's recommendations. Add-on pollution control devices for relatively small equipment have been found to be infeasible.

4.3 Control of Air Pollutants from Emergency Generators

JAX is proposing to install two Cummins 1250DQGAA emergency generators capable of firing ultra-low-sulfur diesel (ULSD). The generators are certified to conform to the applicable EPA emission tier by the engine manufacturer; the Certificates of Conformity are included in **Appendix G** along with the generator specifications.

The proposed emergency generators will each operate no more than 100 hours per year for non-emergency purposes in accordance with 40 CFR Part 60, Subpart IIII and as summarized above in Section 3.2. As such, the units will have the potential to emit 0.04 tons per year (TPY) of PM/PM_{10}, 0.53 TPY of CO, 0.06 TPY of VOC, 2.0 TPY of NOx, and less than 0.01 TPY of SO_2. Additional add-on pollution control for limited operation engines with low potential emissions

would not be economically feasible. JAX is proposing to comply with all Federal and State regulations as BACT for the proposed emergency generators. Specifically, the proposed generators will comply with the following:

- The proposed generators will be certified by the engine manufacturer to comply with EPA's Tier 2 emission standards for non-road engines;
- PM emissions from the generators will not exceed 0.12 lb/MMBtu per 06-096 CMR 103(2)(B)(1)(a);
- PM_{10}, $PM_{2.5}$, NOx, CO, VOC, and SO_2 emissions from the generators will not exceed AP-42 emission factors established in Chapter 3.4 Table 3.4-1: Emission Factors for Large Stationary Diesel Engines;
- Visible emissions from the generators will not exceed 20% opacity on a six-minute block average basis per 06-096 CMR 101(2)(B)(1)(d); and
- The generators will each be limited to 100 hours per year of non-emergency operation in compliance with 40 CFR §60.4211(f).

4.4 Control of Air Pollutants from the Sterilization Units

EtO emissions from sterilization units can be feasibly controlled using add-on pollution control equipment such as wet scrubbers, catalytic oxidizers, or condensers. All three types of pollution control equipment can achieve control efficiencies greater than 99%. Wet scrubbers produce a wastewater effluent that requires disposal and/or treatment, making this pollution control option environmentally infeasible. A condenser would also produce a by-product ethylene oxide stream that would require disposal and treatment, making this pollution control option also environmentally infeasible.

JAX is proposing to install a catalytic oxidizer (abator) as BACT for control of EtO emissions from the sterilization unit. The catalytic oxidizer will control EtO emissions by 99.9%, resulting in an EtO emission rate of 0.0004 lbs/batch. At continuous operation with a catalytic oxidizer, the sterilization unit could potentially emit 1 pound per year of EtO. In addition, JAX will maintain the unit according to the manufacturer's specifications to ensure proper operation.

5. AMBIENT AIR QUALITY MODELING

Pursuant to 06-096 Chapter 115: Major and Minor Source Air Emission License Regulation, Section 7(A), the level of ambient air quality analysis is dependent upon the size of the source, existing air quality, proximity to Class I or nonattainment areas, or areas where increment has been substantially consumed. Specifically, the regulation states "Air quality impact analysis, in general, will not be required of the applicant for those regulated pollutants that are not listed under 'significant emissions increase' in 06-096 CMR 100". As can be seen in Table 5-1 below, the emissions from the JAX-Ellsworth facility will remain below the significant emissions increase thresholds established in 06-096 Chapter 100; thus, modeling was not completed as part of this application.

Table 5-1: Significant Emission Increase Threshold Comparison

Pollutant	Facility PTE [TPY]	Significant Emissions Increase [TPY]	Modeling Required?
$PM/PM_{10}/PM_{2.5}$	7.3	25/15/10	NO
SO_2	0.4	40	NO
NOx	36.8	40	NO
CO	22.9	100	NO
VOC	4.8	40	NO
CO_2e	42,486	75,000	NO

APPENDIX A: CHAPTER 115 APPLICATION FORM

CHAPTER 115
AIR EMISSION LICENSE APPLICATION FORM

State of Maine
Department of Environmental Protection
Bureau of Air Quality
17 State House Station
Augusta, Maine 04333-0017
Phone: (207) 287-2437 Fax: (207) 287-7641

Section A: FACILITY INFORMATION

Owner or Operator (*Legal name as registered with the Secretary of State*):

The Jackson Laboratory

Facility Site Name: The Jackson Laboratory, Building 250

Facility Site Address (*Physical, no post office boxes*): 21 Kingsland Crossing

City/Town: Ellsworth Zip Code: 04605 County: Hancock

Facility Description:

The Jackson Laboratory (JAX) is expanding operations to a new facility in Ellsworth, Maine. The facility will consist of three dual fuel boilers, two propane vaporizers, two emergency generators, and one ethylene oxide sterilization unit. The facility is a new minor source.

Current License #: N/A

Check When Done:

All Sources

X	Application Completed
X	Copy Sent to Town (date sent: **2/24/2017**)
X	Public Notice Published paper name & date: **Ellsworth American, 01/26/2017**
X	Enclosed Public Notice Tear Sheet
X	Signed Signatory Form (Section J)

Additional Requirements for New Sources

X	Schedule for construction or installation of equipment
X	Title, Right, or Interest (e.g. copy of deed or lease)
X	Check for Fee

Additional Requirements for New Major Sources and Major Modifications

	Notify Abutting Landowners

For Department Use

Application #: A- _____ - _____ - _____ - _____

App Track #: _____

Facility Contact:

Name: Norm Burdzel Title: Facilities Engineer III
Company: The Jackson Laboratory
Mailing Address: 600 Main Street

City/Town: Bar Harbor State: ME Zip Code: 04609
Phone: (207) 669-4497 Fax: (207) 288-6497
e-mail: norm.burdzel@jax.org

Application Contact:

Name: Celia Raymond, P.E. Title: Project Engineer
Company: Woodard & Curran
Mailing Address: 41 Hutchins Drive

City/Town: Portland, ME State: ME Zip Code: 04102
Phone: (207) 558-3684 Fax: (207) 774-6635
e-mail: craymond@woodardcurran.com

Billing Contact:

Name: Norm Burdzel Title: Facilities Engineer III
Company: The Jackson Laboratory
Mailing Address: 600 Main Street

City/Town: Bar Harbor State: ME Zip Code: 04609
Phone: (207) 669-4497 Fax: (207) 288-6497
e-mail: norm.burdzel@jax.org

Section B1: STATIONARY FUEL BURNING EQUIPMENT

(List equipment such as boilers, hot water heaters, etc.)

Emission Unit ID	Type of Equipment (boiler, water heater, etc.)	Maximum Design Capacity	Maximum Firing Rate	Fuel Type	% Sulfur	Date of Manufacture	Date of Installation	Stack #
Boiler 1	Steam Boiler	25.0 MMBtu/hr	169 gal/hr, 9,326 SCFH	#2 Fuel Oil, Propane	0.0015%	2017	2017	B1
Boiler 2	Steam Boiler	25.0 MMBtu/hr	169 gal/hr, 9,326 SCFH	#2 Fuel Oil, Propane	0.0015%	2017	2017	B2
Boiler 3	Steam Boiler	8.0 MMBtu/hr	48.7 gal/hr, 3,100 SCFH	#2 Fuel Oil, Propane	0.0015%	2017	2017	B3
Vaporizer 1	Liquid Propane Vaporizer	1.4 MMBtu/hr	14.9 gal/hr	Propane	Neg.	2017	2017	N/A
Vaporizer 2	Liquid Propane Vaporizer	1.4 MMBtu/hr	14.9 gal/hr	Propane	Neg.	2017	2017	N/A

Section B2: INTERNAL COMBUSTION ENGINES

(List equipment such as generators, diesel drive units, fire pumps, etc. Do not list wheeled mobile equipment such as loaders, backhoes, trucks, etc.)

Emission Unit ID	Type of Equipment (generator, direct drive, fire pump, etc.)	Maximum Design Heat Input Capacity (MMBtu/hr)	Maximum Output Capacity (kW or Hp)	Maximum Firing Rate	Fuel Type	% Sulfur	Date of Manf	Date of Installation	Portable	Stationary	Spark Ignition Engines Only			
											2-Stroke	4-Stroke	Rich Burn	Lean Burn
Generator 1	Emergency Generator	12.58	1250 kW	90.5 gal/hr	Diesel	15 ppm	2017	2017		X				
Generator 2	Emergency Generator	12.58	1250 kW	90.5 gal/hr	Diesel	15 ppm	2017	2017		X				

Control Equipment for Fuel Burning Equipment – N/A

If applicable, indicate the types of required/operated add-on pollution control equipment, including baghouses, cyclones/multiclones, SCR, SNCR, etc.

Emission Unit	Type of Control	Pollutant Controlled	Control Efficiency

Monitors for Fuel Burning Equipment: - N/A

If applicable, indicate types of required/operated monitors, including Continuous Emission Monitors (CEM), Continuous Opacity Monitors (COM), parameter monitors for operational purposes, etc.

Emission Unit	Type of Monitor	Data Measured

Section C: INCINERATORS – N/A

Incinerator Type (medical waste, municipal, etc.)	
Waste Type	
Make (Shenandoah, Crawford, etc.)	
Model Number	
Date of Manufacture	
Date of Installation	
Number of Chambers	
Max. Initial Charge	
Max. Design Combustion Rate	
Heat Recovery? (Yes or No)	
Retention Time of Exhaust Gases	
Automatic Feeder? (Yes or No)	
Temperature Range Primary	
Secondary	
Auxiliary Burner - Primary Chamber max. rating (MMBtu/hr)	
type of fuel used	
Auxiliary Burner - Secondary Chamber max. rating (MMBtu/hr)	
type of fuel used	
Annual Waste Combusted (Potential)	
Pollution Control Equipment (if any)	
Stack Number	
Monitors (ie - temperature recorder)	

Section D: PROCESS EQUIPMENT

Emission Unit ID	Type of Equipment	Maximum Raw Material Process Rate (name and rate)	Maximum Finished Material Process Rate (name and rate)	Date of Manufacture	Date of Installation	Stack #	Control Device
Sterilizer 1	EtO Sterilizer	127 gram EtO / batch	N/A	2017	2017	N/A	Catalytic Oxidizer (Abator)

Solvent Cleaners – **N/A**
(Also known as Parts Washers and/or Solvent Degreasers)

Emission Unit ID	Capacity (gallons)	Solvent Used	Solvent % VOC
Degreaser #1 (Example)	*15 (Example)*	*Kerosene (Example)*	*100% (Example)*

PROCESS EQUIPMENT (section D cont'd)

Chemical Usage

Note: Complete this section for any chemicals integral to your process, for example, a cementing process for outersoles, dyes, surface coating, printing, cleaning, etc. Attach additional pages or MSDS sheets as needed.

Process	Chemical substance used in process	Actual Usage Anticipated (lb/yr)	Hazardous chemical(s) in substance	Percent VOC[1] (%)	Percent HAP[2] (%)	Total VOC emitted (lb/year)	Total HAP emitted (lb/year)
Sterilization	Ethylene Oxide	~938	Yes	100	100	~1	~1

[1] Volatile Organic Compounds
[2] Hazardous Air Pollutants

Describe method of record keeping (ie. monthly calculations from purchase records, flow monitors on solvent tanks, etc.)

Purchase records of ethylene oxide cartridges will be maintained.

Describe methods used to calculate VOC/HAP emitted (ie – test results, if control equipment was taken into account; if conditions exist where solvents remain in the substrate rather than complete volatilization, etc.)

Ethylene oxide emissions will be calculated based on total 127 gram cartridges purchased and 99.9% destruction efficiency in the abator.

Section E: STACK DATA

Stack #	Height Above Ground (ft)	Inside Diameter (ft)	Exit Temperature F	Exhaust Flow Rate (ft^3/min) [indicate **actual** or standard]
B1	30’	2’	475	8,905 ACFM
B2	30’	2’	475	8,905 ACFM
B3	30’	1.5’	505	2,914 ACFM
G1	10’	8”	716.5	9,834 ACFM
G2	10’	8”	716.5	9,834 ACFM

Section F: ANNUAL FACILITY FUEL USE - TBD

Total Fuel Consumption by Month for: _____(year)

Fuel Type				
Avg % sulfur				
Avg % moisture (wood)				
Units				
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
Total				

Section G: LIQUID ORGANIC MATERIAL STORAGE

Tank #	1	2		
Capacity (gallons)	40,000	40,000		
Materials Stored	ULSD	LPG		
Reid Vapor Pressure (RVP)	0.019 psi @ 68° F	320 psi @ 68° F		
Annual Throughput	TBD	TBD		
Above or Below Ground?	Underground	Underground		
Tank Type (floating or fixed, riveted or bolted, etc.)	Highland Highguard	Highland Highguard		
Physical Description – year installed	2017	2017		
Physical Description – color	Green	Green		
Dimensions - height (ft)	47’6”	54’5”		
Dimensions - Diameter (ft)	12’	11’		
Construction Material	Steel	Steel		
Control Device	Double walled	N/A (pressurized gas)		

Section H: MISCELLANEOUS – N/A

Note: Use this section to describe any equipment, activities, or other air emission sources that did not fit in any of the above categories. Include descriptions of the associated emissions. Attach additional pages if necessary.

Section I: BPT/BACT AND OTHER ATTACHMENTS

BPT/BACT Analysis:

For a license renewal for existing equipment, the applicant is required to submit a Best Practical Treatment (BPT) analysis to the Department. A BPT analysis establishes what equipment or requirements are appropriate for control or reduction of emissions of regulated pollutants to the lowest possible level considering the existing state of technology, the effectiveness of available alternatives, and the economic feasibility.

For a new license or the addition of new equipment to an existing license, the applicant is required to submit a Best Available Control Technology (BACT) analysis. A BACT analysis is a top-down approach to selecting air emission controls. It is done on a case-by-case basis and develops emission limits based on the maximum degree of reduction for each pollutant emitted taking into account economic, environmental and energy impacts.

☐ I certify that, to the best of my knowledge, the control equipment, fuel limitations, and process constraints outlined in this application represent BPT / BACT for the equipment and processes listed.

OR

☒ I have attached a separate BPT / BACT analysis to this application.

Other Attachments:

Please list any other attachments included with this application.

Air License Modification Application Report
Appendix B – Cover Letter to City of Ellsworth
Appendix C – Public Notice of Intent to File
Appendix D – Facility Site Plan and Site Location Plan
Appendix E – Emissions Calculation
Appendix F-J – Equipment Specifications
Appendix K – Property Deed

Section J: APPLICABLE RULES

Please indicate any rules you believe may be applicable to your facility by checking the associated box.

	Citation	Title
X	06-096 CMR 101	Visible Emissions
X	06-096 CMR 103	Fuel Burning Equipment Particulate Emission Standard
	06-096 CMR 104	Incinerator Particulate Emission Standard
	06-096 CMR 105	General Process Source particulate Emission Standard
X	06-096 CMR 106	Low Sulfur Fuel Regulation
	06-096 CMR 111	Petroleum Liquid Storage Vapor Control
	06-096 CMR 112	Bulk Terminal Petroleum Liquid Transfer Requirements
	06-096 CMR 117	Source Surveillance
	06-096 CMR 118	Gasoline Dispensing Facilities Vapor Control
	06-096 CMR 121	Emission Limitations and Emission Testing of Resource Recovery Facilities
	06-096 CMR 123	Paper Coating Regulation
	06-096 CMR 124	Total Reduced Sulfur Control from Kraft Mills
	06-096 CMR 125	Perchloroethylene Dry Cleaner Regulation
	06-096 CMR 126	Capture Efficiency Test Proceedures
	06-096 CMR 129	Surface Coating Facilities
	06-096 CMR 130	Solvent Degreasers
	06-096 CMR 131	Cutback Asphalt and Emulsified Asphalt
	06-096 CMR 132	Graphic Arts – Rotogravure and Flexography
	06-096 CMR 133	Petroleum Liquids Transfer Vapor Recovery at Bulk Gasoline Plants
	06-096 CMR 134	Reasonably Available Control Technology for Facilities That Emit Volatile Organic Compounds
X	06-096 CMR 137	Emission Statements
	06-096 CMR 138	Reasonably Available Control Technology for Facilities That Emit Nitrogen Oxides
	06-096 CMR 140	Part 70 Air Emission License Regulations
	06-096 CMR 145	NOx Control Program
	06-096 CMR 153	Mobile Equipment Repair and Refinishing
	06-096 CMR 159	Control of Volatile Organic Compounds from Adhesives and Sealants
	06-096 CMR 161	Graphic Arts – Offset Lithography and Letterpress Printing
X	40 CFR Part 60	New Source Performance Standards (NSPS) (please list Subpart(s): Subpart IIII, Subpart Dc)
X	40 CFR Part 63	National Emission Standards for Hazardous Air Pollutants (NESHAP) (please list Subpart(s): Subpart JJJJJJ)
	Other (list)	
	Other (list)	

Section K: SIGNATORY REQUIREMENT

Each application submitted to the Department must include the following certification signed by a Responsible Official*:

"I certify under penalty of law that, based on information and belief formed after reasonable inquiry, I believe the information included in the attached document is true, complete, and accurate."

Responsible Official Signature — Date: 3/30/17

David A. Kuchta — Responsible Official (Printed or Typed)

Maintenance & Utility Plant Manager — Title

* A Responsible Official is defined by MEDEP Rule, Chapter 100 as:

A. For a corporation: a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit and either:

(1) The facilities employ more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars); or

(2) The delegation of authority to such representatives is approved in advance by the permitting authority;

B. For a partnership or sole proprietorship: a general partner or the proprietor, respectively;

C. For a municipality, State, Federal, or other public agency: Either a principal executive officer or ranking elected official. For the purposes of this part, a principal executive officer of a Federal agency includes the chief executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., a Regional Administrator of EPA).

APPENDIX B: COVER LETTER TO CITY OF ELLSWORTH

COMMITMENT & INTEGRITY
DRIVE RESULTS

41 Hutchins Drive
Portland, Maine 04102
www.woodardcurran.com

T 800.426.4262
T 207.774.2112
F 207.774.6635

March 31, 2017

Heidi Noël Grindle
City Clerk
City of Ellsworth
1 City Hall Plaza
Ellsworth, ME 04605

RE: 06-096 CMR 115 Air License Minor Source Application: The Jackson Lab, Building 250 Ellsworth, Maine

Dear Ms. Grindle:

On behalf of The Jackson Laboratory and in accordance with the Maine Department of Environmental Protection (Maine DEP) regulations, Woodard & Curran is providing the enclosed copy of The Jackson Laboratory's 06-096 CMR 115 air emissions license minor source application for the installation of three boilers, two propane vaporizers, two emergency generators, and one sterilization unit at the new Building 250 facility.

Please make this application available to the public upon request.

Should you have any questions or comments concerning this application, please do not hesitate to contact me at 207-558-3684.

Sincerely,

WOODARD & CURRAN

Celia Raymond, P.E.
Project Engineer

Enclosure(s) 06-096 CMR 115 Air License Minor Source Application

cc: Norm Burdzel, The Jackson Laboratory
Lynn Muzzey, Maine DEP, Bureau of Air Quality

APPENDIX C: PUBLIC NOTICE OF INTENT TO FILE

The Ellsworth American. Mount Desert Islander

PUBLIC NOTICES

The Jackson Laboratory

March 30, 2017

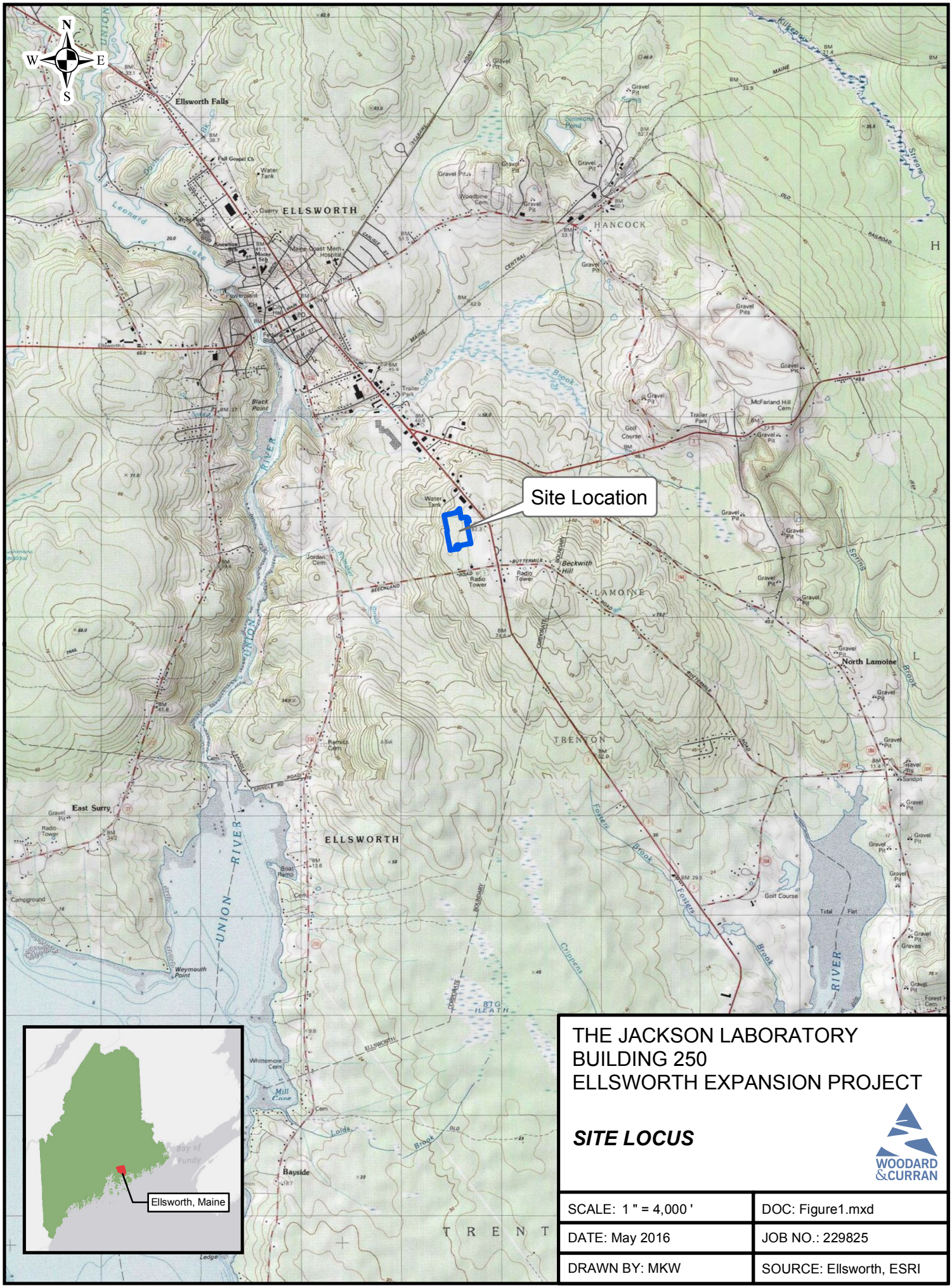
Please take notice that The Jackson Laboratory intends to file an Air Emission License Application with the Maine Department of Environmental Protection (DEP) pursuant to the provisions of 38 M.R.S.A., Section 590 on or about March 29, 2017. JAX is submitting a 06-096 CMR 115 application to permit the conversion of the existing structure at 21 Kingsland Crossing Ellsworth, Maine (formerly the Lowes building) into a high barrier vivarium that will supplement and expand their current mouse production capacity in Bar Harbor. According to Department regulations, interested parties must be publicly notified, written comments invited, and if justified an opportunity for public hearing given. A request for a public hearing or for the Board of Environmental Protection to assume jurisdiction must be received by the Department, in writing, no later than 20 days after the application is accepted by the Department as complete for processing.

The application and supporting documentation will be available for review at the Bureau of Air Quality DEP offices in Augusta, (207) 287-2437, during normal working hours. A copy of the application and supporting documentation will also available at the municipal office in Ellsworth, Maine.

Written public comments may be sent to Lynn Muzzey at the Bureau of Air Quality, State House Station #17, Augusta, Maine 04333.

This entry was posted in Intent to File, Public Notices. Bookmark the permalink.

APPENDIX D: FACILITY SITE PLAN AND SITE LOCATION PLAN



THE JACKSON LABORATORY
BUILDING 250
ELLSWORTH EXPANSION PROJECT

SITE LOCUS

WOODARD &CURRAN

SCALE: 1 " = 4,000 '	DOC: Figure1.mxd
DATE: May 2016	JOB NO.: 229825
DRAWN BY: MKW	SOURCE: Ellsworth, ESRI

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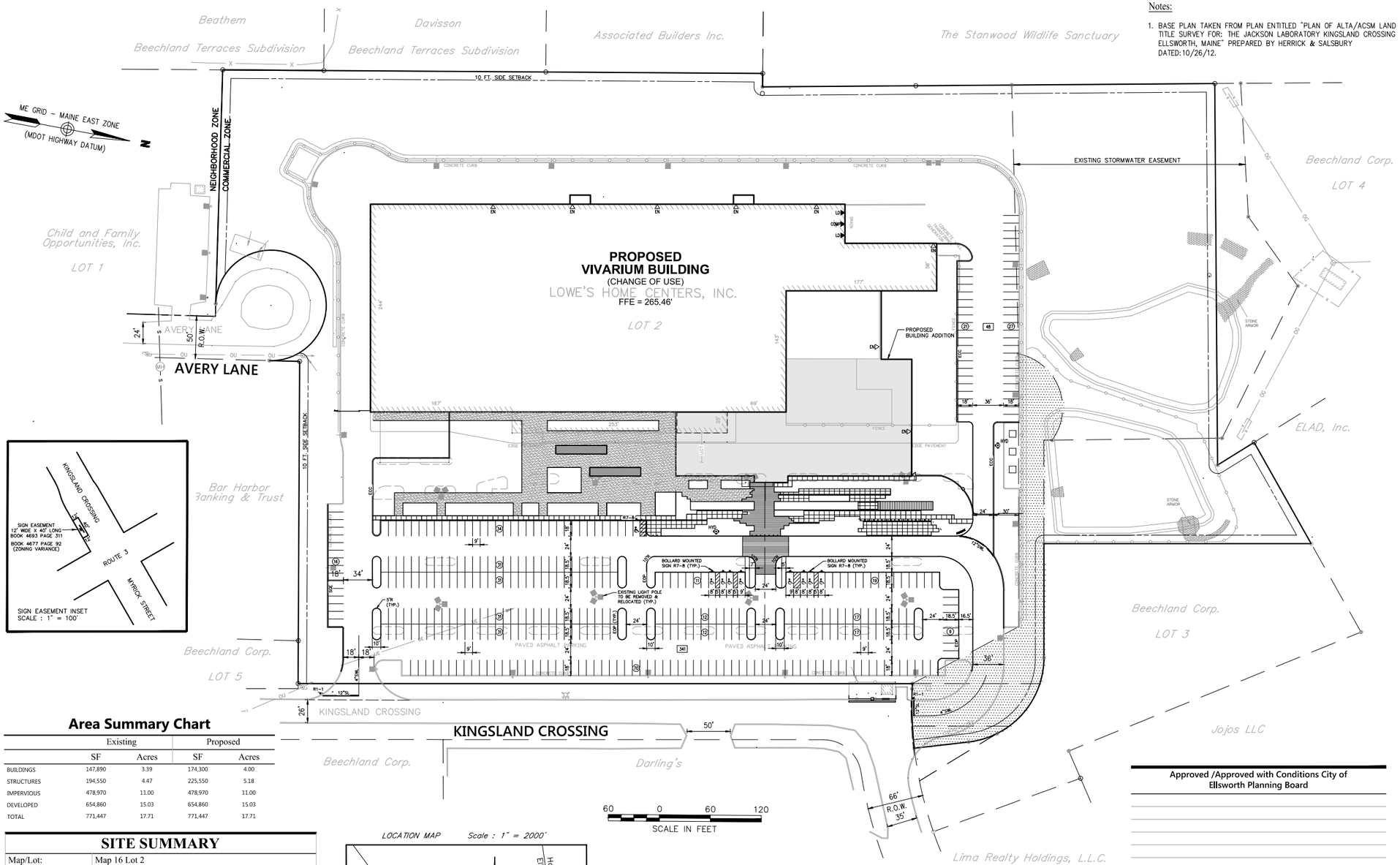


Notes:

1. BASE PLAN TAKEN FROM PLAN ENTITLED "PLAN OF ALTA/ACSM LAND TITLE SURVEY FOR: THE JACKSON LABORATORY KINGSLAND CROSSING ELLSWORTH, MAINE" PREPARED BY HERRICK & SALSBURY DATED: 10/26/12.

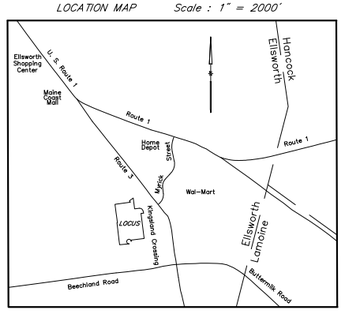
Area Summary Chart

	Existing		Proposed	
	SF	Acres	SF	Acres
BUILDINGS	147,890	3.39	174,300	4.00
STRUCTURES	194,550	4.47	225,550	5.18
IMPERVIOUS	478,970	11.00	478,970	11.00
DEVELOPED	654,860	15.03	654,860	15.03
TOTAL	771,447	17.71	771,447	17.71

SITE SUMMARY

Map/Lot:	Map 16 Lot 2
Address:	21 Kingsland Crossing
Lot Size:	17.71 ac
Existing Use:	Retail (Lowe's)
Proposed Use:	Laboratory (Vivarium) with Central Utility Plant
Existing Impervious:	11 ac
Proposed Impervious:	11 ac (No Increase)
Existing Building:	147,890 SF
Proposed Building:	174,300 SF (32,000 SF Expansion)
Wastewater:	Existing Service On-Site via Municipal Line in Kingsland Crossing (with pump station)
Water:	Existing Looped Service On-Site via 12-inch Municipal Line in Kingsland Crossing
Stormwater:	Existing Detention Basins
Easements:	Sewer and Drainage

LOCATION MAP Scale : 1" = 2000'



Zoning Summary Chart

Zoning District(S): Commercial

Zoning Regulation Requirements	Existing	Required	Provided
MINIMUM LOT AREA	771,448 SF	20,000 SF	771,448 SF
FRONTAGE	793.6 Feet	100.0 Feet	793.6 Feet
FRONT YARD SETBACK	300 Feet	0 Feet	235 Feet
SIDE YARD SETBACK	50 Feet	10 Feet	50 Feet
REAR YARD SETBACK	125 Feet	10 Feet	125 Feet
MAXIMUM BUILDING HEIGHT	31'-4"	65 Feet	31'-4"
MAXIMUM IMPERVIOUS	62.0 %	75.0 %	62.0 %

Approved /Approved with Conditions City of Ellsworth Planning Board

WAIVERS/CONDITIONS:

DATE:

vhb.com

vhb

500 Southborough Drive
Suite 105B
South Portland, ME 04106
207.889.3150

EYP Architecture & Engineering
Independence Wharf
470 Atlantic Ave. 7th Floor
Boston, MA 02210
Telephone 617 305 9800

eypae.com

EYP

WOODARD & CURRAN
One Merchants Plaza, Suite 501 | Bangor, Maine 04401
800.564.2333 | www.woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

CES INC
Engineers • Environmental Scientists • Surveyors
465 South Main Street, Brewer, Maine 04412

PREPARED FOR:

The Jackson Laboratory
600 Main Street
Bar Harbor, Maine 04609

Building 250 Ellsworth Expansion Project

21 Kingsland Crossing
Ellsworth, Maine

No.	Revision	Date	Appvd.

Designed by | Checked by

Issued for: Sketch Plan Review
Date: Oct. 13, 2016

Not Approved for Construction

Drawing Title: Conceptual Site Plan

Drawing Number: C-1

Sheet 1 of 1

Project Number: 52426

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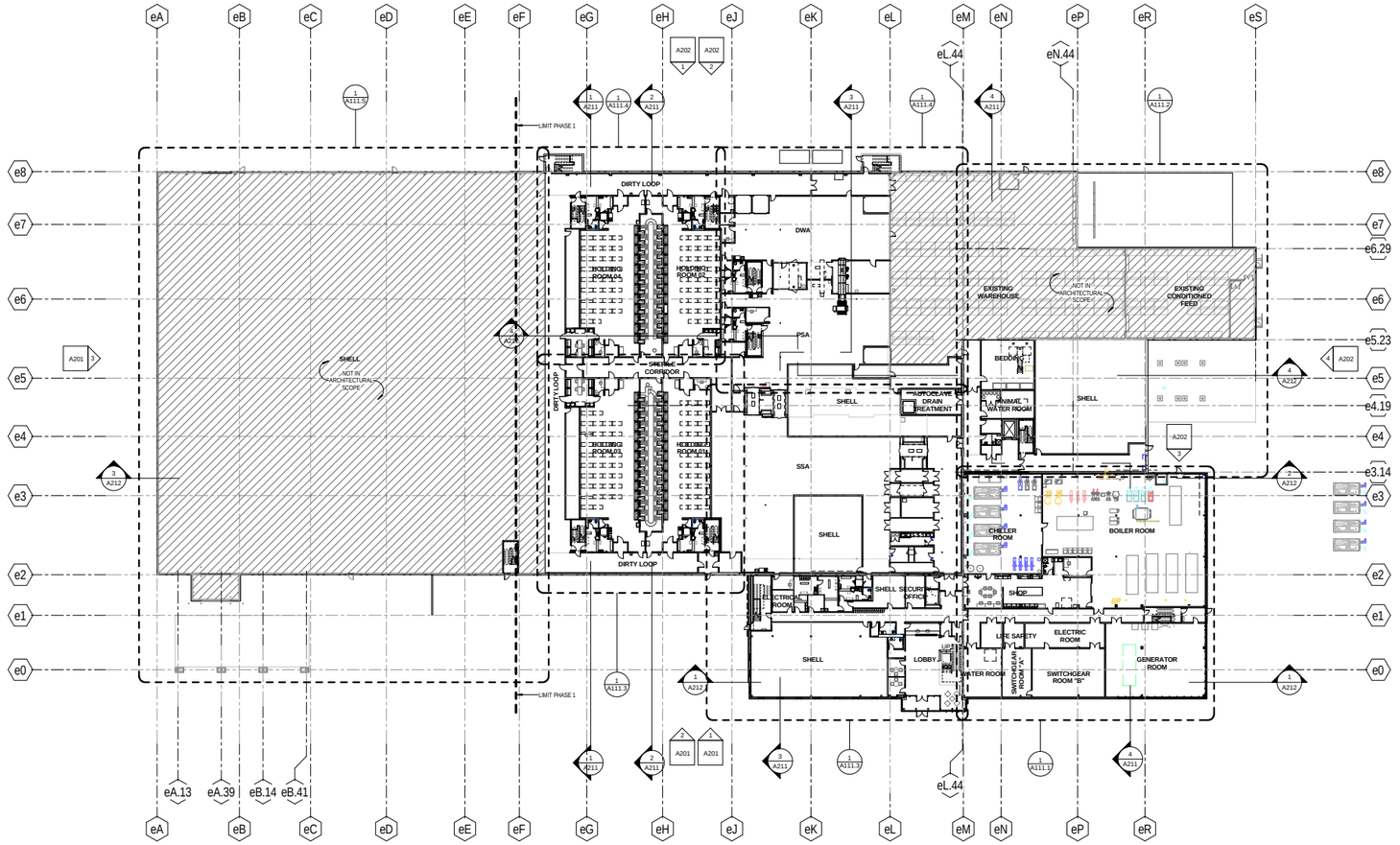

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EYP Architecture & Engineering
Independence Wharf
470 Atlantic Ave. 7th Floor
Boston, MA 02210
Telephone 617 305 9800

eypae.com

EYP/

CONSULTANTS:

KEY PLAN:

#	Revision	Date

BUILDING 250
ELLSWORTH EXPANSION

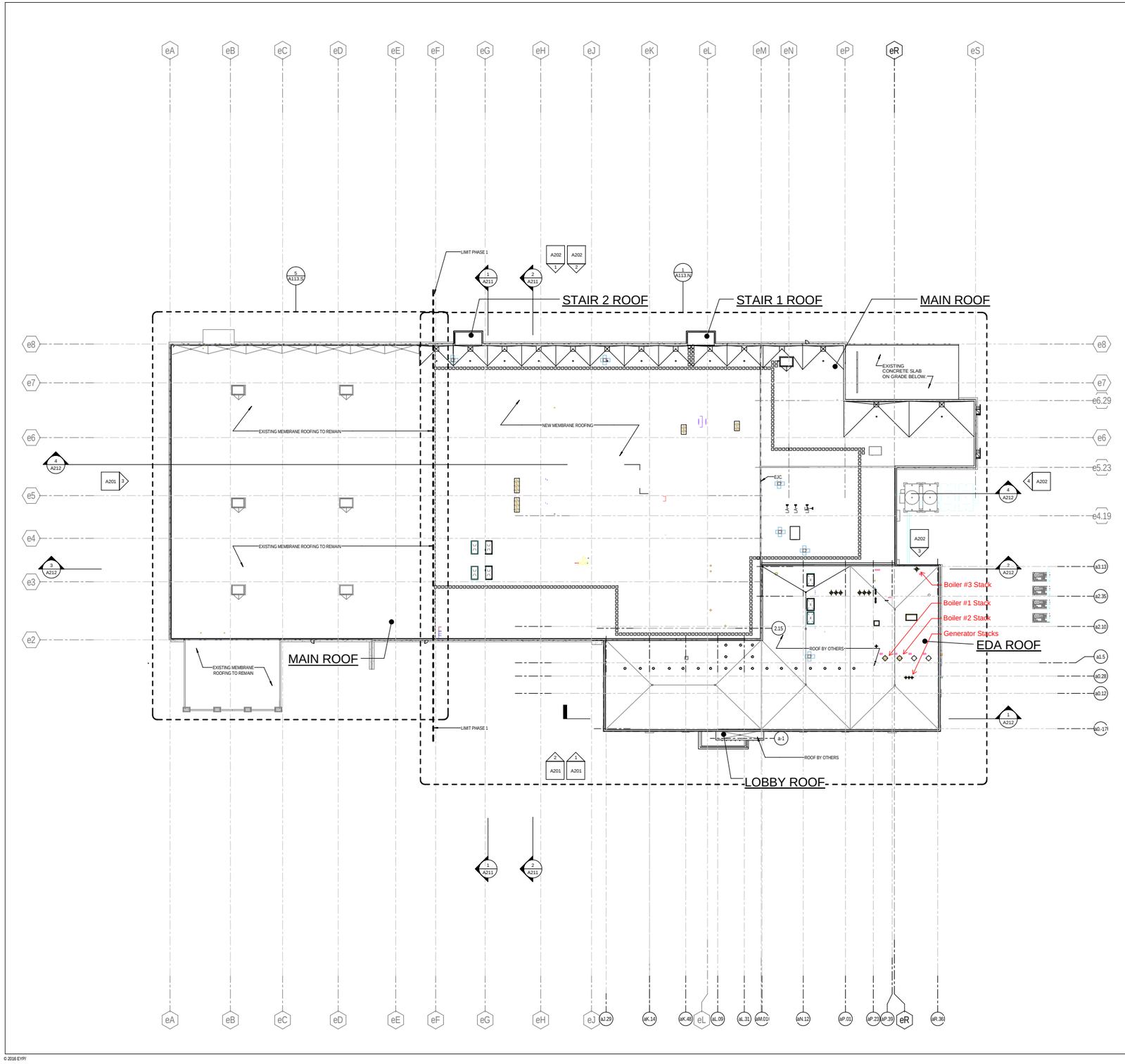
THE JACKSON LABORATORY
21 KINGSLAND CROSSING
ELLSWORTH, ME 04605

CONSTRUCTION DOCUMENTS

DATE:	NOVEMBER 15, 2016
SCALE:	1" = 30'-0"
EYP PROJECT NO.:	3015014.01
CLIENT PROJECT NO.:	
DESIGNED BY:	PD
DRAWN BY:	PB
CHECKED BY:	HT

LEVEL 1 PLAN

A101



EYP Architecture & Engineering
Independence Wharf
470 Atlantic Ave. 7th Floor
Boston, MA 02210
Telephone 617 305 9800

eypae.com

EYP/

CONSULTANTS:

KEY PLAN:

#	Revision	Date

BUILDING 250
ELLSWORTH EXPANSION

THE JACKSON LABORATORY
21 KINGSLAND CROSSING
ELLSWORTH, ME 04605

CONSTRUCTION DOCUMENTS

DATE:	NOVEMBER 15, 2016
SCALE:	1" = 30'-0"
EYP PROJECT NO.:	3015014.01
CLIENT PROJECT NO.:	
DESIGNED BY:	PD
DRAWN BY:	RBF/ MG
CHECKED BY:	HT

ROOF PLAN **A103**

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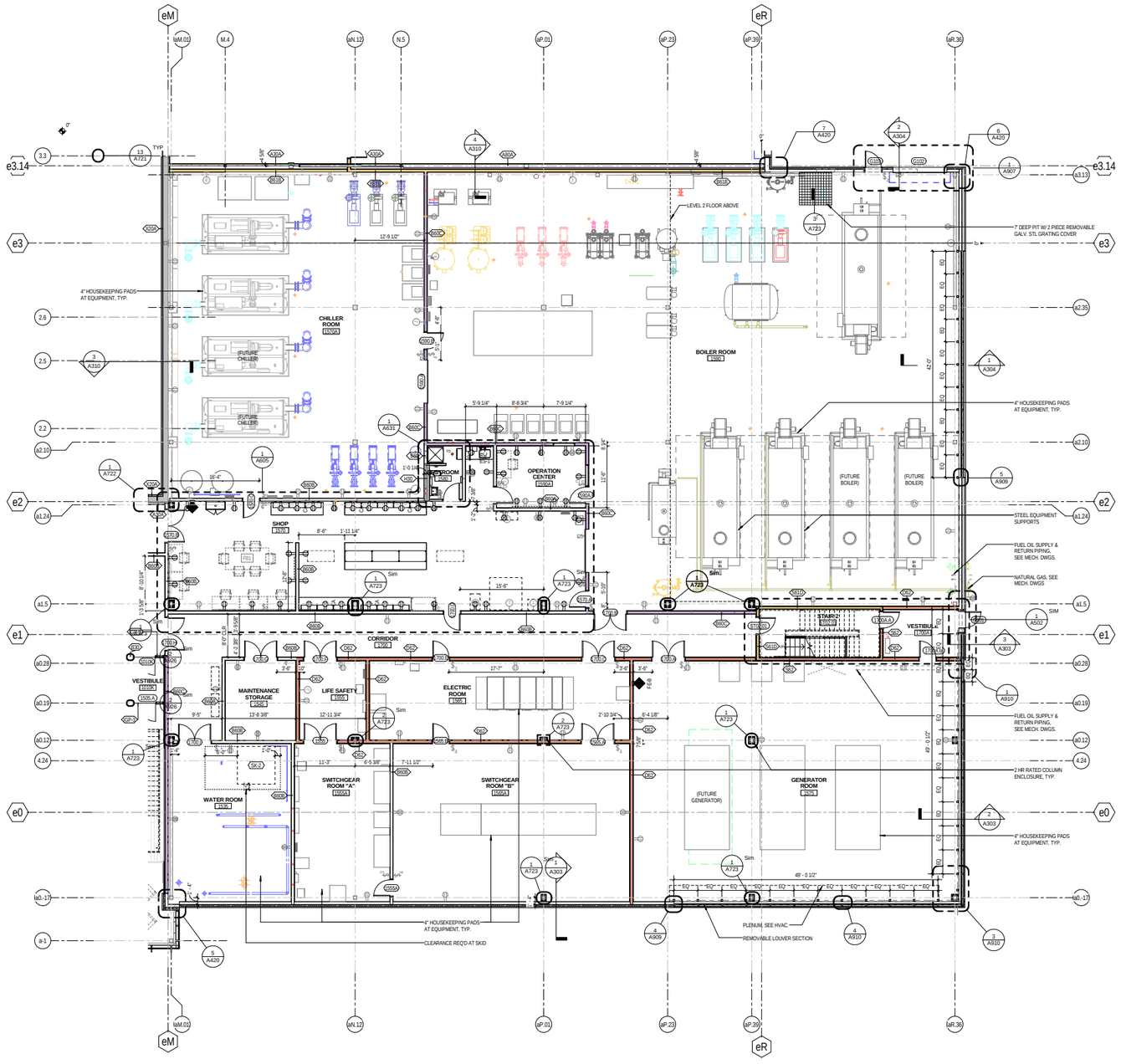

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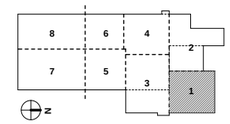
Independence Wharf
470 Atlantic Ave. 7th Floor
Boston, MA 02210
Telephone 617 305 9800

eypae.com

EYP/

CONSULTANTS:



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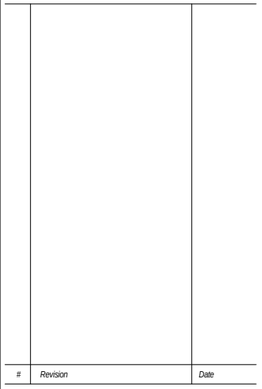

#	Revision	Date

BUILDING 250
ELLSWORTH EXPANSION

THE JACKSON LABORATORY
21 KINGSLAND CROSSING
ELLSWORTH, ME 04605

CONSTRUCTION DOCUMENTS

DATE:	NOVEMBER 15, 2016
SCALE:	1/8" = 1'-0"
EYP PROJECT NO.:	3015014.01
CLIENT PROJECT NO.:	
DESIGNED BY:	PD
DRAWN BY:	PB
CHECKED BY:	HT

LEVEL 1 ZONE 1 PLAN

A111.1

APPENDIX E: EMISSION CALCULATIONS

Boiler #1 and Boiler #2

Boiler Make: Cleaver Brooks
Boiler Model: FLX-200-2500-150ST
Rated Capacity: 25 MMBtu/hr
Fuel Type: No. 2 Fuel Oil
Propane Gas

Table 1: Boiler 1 and Boiler 2 No. 2 Fuel Oil Emissions (each)

Pollutant	No. 2 Fuel Oil Emissions				Emission Factor Source[2]
	[lb/1000 gal]	[lb/MMBtu][1]	[lb/hr]	[TPY]	
NOx	--	0.110	2.75	12.05	Manufacturer's Specifications
CO	5	0.036	0.89	3.91	AP-42
PM Filterable	2	0.014	0.36	1.56	AP-42
PM Condensable	1.3	0.009	0.23	1.02	AP-42
VOC	--	0.016	0.40	1.75	Manufacturer's Specifications
SO_2	0.213	0.002	0.04	0.17	AP-42
CO_2	22,300	159	3,982	17,507	AP-42
CH_4	0.216	0.002	0.04		AP-42
N_2O	0.26	0.002	0.05		AP-42

[1] Assuming a No. 2 Fuel Oil heat input of 140 MMBtu/1000 gal
[2] AP-42 Section 1.3 Emission Factors for Distillate Oil Fired Boilers

Table 2: Boiler 1 and Boiler 2 Propane Emissions (each)

Pollutant	Propane Emissions				Emission Factor Source[2]
	[lb/1000 gal]	[lb/MMBtu][1]	[lb/hr]	[TPY]	
NOx	--	0.050	1.25	5.48	Manufacturer's Specifications
CO	7.5	0.082	2.05	8.98	AP-42
PM Filterable	--	0.019	0.47	2.06	Manufacturer's Specifications
PM Condensable	0.5	0.005	0.14	0.60	AP-42
VOC	1.0	0.011	0.27	1.20	AP-42
SO_2	--	0.001	0.03	0.12	Manufacturer's Specifications
CO_2	12500	136.612	3,415	15,286	AP-42
CH_4	0.2	0.002	0.05		AP-42
N_2O	0.9	0.010	0.25		AP-42

[1] Assuming a propane heat input of 91.5 MMBtu/1000 gal
[2] AP-42 Section 1.6 Emission Factors for Propane Fired Commercial Boilers

Table 3: Boiler 1 and Boiler 2 Potential to Emit

Pollutant	Fuel Oil PTE (each)	Propane PTE (each)	Each PTE	Total PTE
	[TPY]	[TPY]	[TPY]	[TPY]
NOx	12.05	5.48	12.05	24.09
CO	3.91	8.98	8.98	17.95
PM Filterable	1.56	2.06	2.06	4.12
PM Condensable	1.02	0.60	1.02	2.03
VOC	1.75	1.20	1.75	3.50
SO_2	0.17	0.12	0.17	0.33
CO_2e	17,507	15,286	17,507	35,013

Boiler #3

Boiler Make: Cleaver Brooks
Boiler Model: FLX-200-800-150ST
Rated Capacity: 8 MMBtu/hr
Fuel Type: No. 2 Fuel Oil
Propane Gas

Table 4: Boiler 3 No. 2 Fuel Oil Emissions

Pollutant	No. 2 Fuel Oil Emissions				Emission Factor Source[2]
	[lb/1000 gal]	[lb/MMBtu][1]	[lb/hr]	[TPY]	
NOx	--	0.200	1.60	7.01	Manufacturer's Specifications
CO	--	0.039	0.31	1.37	Manufacturer's Specifications
PM Filterable	2	0.014	0.11	0.50	AP-42
PM Condensable	1.3	0.009	0.07	0.33	AP-42
VOC	--	0.030	0.24	1.05	Manufacturer's Specifications
SO_2	0.213	0.002	0.01	0.05	AP-42
CO_2	22,300	159	1,274	5,602	AP-42
CH_4	0.216	0.002	0.01		AP-42
N_2O	0.26	0.002	0.01		AP-42

[1] Assuming a No. 2 Fuel Oil heat input of 140 MMBtu/1000 gal
[2] AP-42 Section 1.3 Emission Factors for Distillate Oil Fired Boilers

Table 5: Boiler 3 Propane Emissions

Pollutant	Propane Emissions				Emission Factor Source[2]
	[lb/1000 gal]	[lb/MMBtu][1]	[lb/hr]	[TPY]	
NOx	--	0.053	0.42	1.86	Manufacturer's Specifications
CO	7.5	0.082	0.66	2.87	AP-42
PM Filterable	--	0.019	0.15	0.66	Manufacturer's Specifications
PM Condensable	0.5	0.005	0.04	0.19	AP-42
VOC	1.0	0.011	0.09	0.38	AP-42
SO_2	--	0.001	0.01	0.04	Manufacturer's Specifications
CO_2	12500	136.612	1,093	4,892	AP-42
CH_4	0.2	0.002	0.02		AP-42
N_2O	0.9	0.010	0.08		AP-42

[1] Assuming a propane heat input of 91.5 MMBtu/1000 gal
[2] AP-42 Section 1.6 Emission Factors for Propane Fired Commercial Boilers

Table 6: Boiler 3 Potential to Emit

Pollutant	Fuel Oil PTE	Propane PTE	Overall PTE
	[TPY]	[TPY]	[TPY]
NOx	7.01	1.86	7.01
CO	1.37	2.87	2.87
PM Filterable	0.50	0.66	0.66
PM Condensable	0.33	0.19	0.33
VOC	1.05	0.38	1.05
SO_2	0.05	0.04	0.05
CO_2e	5,602	4,892	5,602

Generator #1 and #2

Generator Make: Cummins
Generator Model: 1250DQGAA
Engine Model: QSK50-G4 NR2
Power Rating: 1250 kW
Rated Input 12.58 MMBtu/hr
Capacity: 90.5 gallon/hr
Fuel Type: Ultra Low Sulfur Diesel

Table 7: Generator #1 and #2 Emissions (Per Unit)

Pollutant	Diesel Emissions[1]		
	[lb/MMBtu][2]	[lb/hr]	[TPY][3]
NOx	3.200	40.25	2.01
CO	0.850	10.69	0.53
PM Filterable	0.062	0.78	0.04
PM Condensable	0.008	0.10	0.00
VOC	0.090	1.13	0.06
SO_2	0.002	0.02	0.00
CO_2	165	2,076	104
CH_4	0.007	0.08	
N_2O	0.001	0.01	

[1] AP-42 Section 3.4 Emission Factors for Large Diesel Internal Combustion Engines
[2] Assuming a Diesel heat input of 139 MMBtu/1000 gal
[3] Based on 100 hour per year of non-emergency operation

Table 8: Generator #1 and Generator #2 Potential to Emit

Pollutant	Generator #1	Generator #2	Total PTE
	[TPY]	[TPY]	[TPY]
NOx	2.01	2.01	4.03
CO	0.53	0.53	1.07
PM Filterable	0.04	0.04	0.08
PM Condensable	0.00	0.00	0.01
VOC	0.06	0.06	0.11
SO_2	0.00	0.00	0.00
CO_2e	104	104	208

Propane Vaporizer 1 and Vaporizer 2

Vaporizer Make: Ransome Manufacturing (or equivalent)
Vaporizer Model: RH1000 (or equivalent)
Rated Capacity: 1.3592 MMBtu/hr
14.9 gal/hr
Fuel Type: Propane Gas

Table 9: Vaporizer 1 and Vaporizer 2 Propane Emissions (each)

Pollutant	Propane Emissions[1]			
	[lb/1000 gal]	[lb/MMBtu][2]	[lb/hr]	[TPY]
NOx	13.0	0.142	0.19	0.85
CO	7.5	0.082	0.11	0.49
PM Filterable	0.2	0.002	0.00	0.01
PM Condensable	0.5	0.005	0.01	0.03
VOC	1.0	0.011	0.01	0.07
SO_2	0.018	0.000	0.00	0.00
CO_2	12500	136.612	186	831
CH_4	0.2	0.002	0.00	
N_2O	0.9	0.010	0.01	

[1] AP-42 Section 1.6 Emission Factors for Propane Fired Commercial Boilers
[2] Assuming a propane heat input of 91.5 MMBtu/1000 gal

Table 10: Vaporizer 1 and Vaporizer 2 Potential to Emit

Pollutant	Propane PTE (each)	Total PTE
	[TPY]	[TPY]
NOx	0.85	1.69
CO	0.49	0.98
PM Filterable	0.01	0.03
PM Condensable	0.03	0.07
VOC	0.07	0.13
SO_2	0.00	0.00
CO_2e	831	1662.13

Ethylene Oxide Sterilization Unit

Sterilizer Make: 3M
Sterilizer Model: Steri-Vac™ Sterilizer GS5X
Abator Model: EO Abator 50AN

Table 11: Potential EtO Emissions Based on Continuous Operation

EtO per Cartridge:	127	[gm/batch]
	0.28	[lb/batch]
Minimum Batch Time:	3.5	[hrs/batch]
Potential Operation:	8760	[hrs/yr]
Number of Units:	1	[-]
Potential Batches:	2503	[batches/yr]
EtO Usage Per Year:	701	[lbs/yr]
Abator Control:	99.9%	[%]
EtO Emissions:	**1**	**[lbs/yr]**

Table 12: Potential CO_2 Emissions Based on Continuous Operation

EtO Usage Per Year:	701	[lbs/yr]
EtO Destruction Efficiency:	99.9%	[%]
EtO Destroyed Per Year:	700.099	[lbs/yr]
Moles EtO Destroyed:	15.9	[lbmol]
Moles of CO_2 Produced:	31.8	[lbmol]
CO_2 Produced Per Year:	1398.9	[lbs/yr]
	0.70	[TPY]

Table 13: Criteria Air Pollutant Facility-Wide Potential to Emit

Pollutant	Boiler #1 [TPY]	Boiler #2 [TPY]	Boiler #3 [TPY]	Generators [TPY]	Vaporizers [TPY]	ETO Sterilizer [TPY]	Total [TPY]
NOx	12.0	12.0	7.0	4.0	1.7	--	36.8
CO	9.0	9.0	2.9	1.1	1.0	--	22.9
PM Filterable	2.1	2.1	0.7	0.1	0.0	--	4.9
PM Condensable	1.0	1.0	0.3	0.0	0.1	--	2.4
VOC	1.8	1.8	1.1	0.1	0.1	0.0	4.8
SO_2	0.2	0.2	0.1	0.0	0.0	--	0.4
CO_2e	17,507	17,507	5,602	208	1,662	1	42,486

Table 14: Hazardous Air Pollutant Facility-Wide Potential to Emit

Pollutant	ETO Sterilizer [TPY]	Total [TPY]
Ethylene Oxide	0.0004	0.0004
Total HAPS	0.0004	0.0004

Table 14: Air License Fee

Pollutant	Facility PTE [TPY]	Fee Per Ton [$/ton]	Fee Amount [$]
NOx	36.8	$8.83	$325.08
PM	7.3	$8.83	$64.58
VOC	4.8	$8.83	$42.37
SO_2	0.4	$8.83	$3.45
TOTAL	49.3	--	$435.48

APPENDIX F: BOILER SPECIFICATION SHEETS

Boiler #1 and Boiler #2

First System Requirements:	Watertube Boiler
Application:	Steam
Fuel Series:	Propane Gas, 2 Oil
Boiler Capacity:	25,000 MBTU Input
Design Pressure:	150lb ST
Operating Pressure:	100 psig
Safety Valve Setpoint:	125lb
Gas NOx Emissions Level:	30 ppm
Oil NOx Emissions Level:	90 ppm
Gas CO Emissions Level:	100 ppm
Oil CO Emissions Level:	50 ppm
Available Site Voltage:	460/3/60
Available Site Gas Pressure:	148 Inches w.c. 5 #
Approximate Site Altitude:	2000 ft. ASL
Field Assembled Unit:	No
Insurance Requirements:	Standard - No Additional Requirements
Proposed System Solution:	FLX-200-2500-150ST (460/3/60)-STD/CFG (Qty: 1)

Boiler #3

Second System Requirements:	Watertube Boiler
Application:	Steam
Fuel Series:	Propane Gas, 2 Oil
Boiler Capacity:	8,000 MBTU Input
Design Pressure:	150lb ST
Operating Pressure:	100 psig
Safety Valve Setpoint:	125lb
Gas NOx Emissions Level:	Uncontrolled
Oil NOx Emissions Level:	140 ppm
Gas CO Emissions Level:	150 ppm
Oil CO Emissions Level:	100 ppm
Available Site Voltage:	460/3/60
Available Site Gas Pressure:	Inches w.c.
Approximate Site Altitude:	2000 ft. ASL
Field Assembled Unit:	No
Insurance Requirements:	NFPA-85 2011 (XL-Gap)
Proposed System Solution:	FLX-200-800-150ST (460/3/60)-STD/CFG (Qty: 1)

Third System Requirements:	Packaged Water System
Application:	Duo Tank
Duo Tank System Type:	Piggy Back
Required Feedwater Components:	Tank, Controls (Trim), Stand, Pump
Feedwater Tank Type:	Deaerator
Feedwater Tank Design Pressure:	50 lb
Feedwater Tank Storage Time:	10 Minutes
Required Transfer Components:	Tank, Controls (Trim), Stand, Pump
Transfer Tank Type:	Surge
Transfer Tank Design Pressure:	Atmospheric
Transfer Tank Storage Time:	10 Minutes
Number of Boiler Sets:	1
Tank Sizing Criteria:	Total Boiler Horsepower
Main Power Voltage:	460/3/60
Boiler Set #1:	Boiler Quantity: 5
	Boiler Capacity (Each): 600 HP Input
	Operating Pressure: 100 psig
	Total Pumpset System Operating Pressure: 115 psig
	Safety Valve Setpoint: 150 lb
	Feedwater Pumpset System: (6) - 1 Pump Per Boiler w/ 1 Pump Backup, Continuous Operation, TEFC Motor Type
Transfer Pumpset System:	(3) - 2 Pumps w/ 1 Standby, Continuous Operation, TEFC Motor Type
Feedwater Tank Water:	Primary Source: Condensate
	Primary Source Pressure: 50 psig
	Secondary Source: MakeUp
	Secondary Source Pressure: 50 psig
	Low Temperature Condensate Return Flow Rate: 80%
	Low Temperature Condensate Return Temperature: 175°F
	High Temperature Condensate Return Flow Rate: 0% Because it is so low?

Boiler #3

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - Gas Fuel — Rev 1 - Corrected Fuel HHV

Project No: TBD

BACKGROUND INFORMATION

Date	3/31/2017	Page 1 of 3
Author	Victor Cerbins	
Customer	Jackson Labs	
City & State	Mass.	
Boiler Model	FLX200-800, 150#	
Burner Model	Profire V Series, Model LNVLG080	
Design Pressure (psig)	150, ASME SECTION I; "S" Stamped	
Furnace Volume (cuft)	94.6	
Heating Surface (sqft)	769.9	

	100%	75%	50%	25%
ENTHALPY				
Steam Enthalpy, hg (Btu/lb)	1187	1187	1187	1187
Feedwater Enthalpy, hfw (Btu/lb)	180	180	180	180
LOAD				
Operating BHP	191	143	96	47
Steam Flow Rate, (lb/hr)	6,303	4,719	3,168	1,551
Firing Rate	**100%**	**75%**	**50%**	**25%**
Fuel Type	**Propane Gas**	**Propane Gas**	**Propane Gas**	**Propane Gas**
Fuel HHV (Btu/SCF) 2577	See Below			
EXCESS AIR				
Excess Air Leaving Boiler	15.0%	25.0%	25.0%	25.0%
CO_2 Leaving Boiler	10.8%	10.5%	10.5%	10.0%
PRESSURE				
Steam Operating Pressure, (psig)	90	90	90	90
TEMPERATURES				
Flue Gas Temp. Leaving Boiler (^oF)	490	475	430	395
Feedwater Temperature, T fw (^oF)	212	212	212	212
Combustion Air Temperature (^oF)	80	80	80	80
Steam Temperature (^oF)	331	331	331	331
ENERGY				
Heat Output, (kBtu/hr)	6,394	4,787	3,214	1,573
HHV Fuel-to-Steam Efficiency (%)	81.9	82.5	83	82.71
HHV Heat Input (Btu/hr)	7,807	5,802	3,872	1,902

Boiler #3

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - Gas Fuel — Rev 1 - Corrected Fuel HHV

Project No: TBD

BACKGROUND INFORMATION

Date	3/31/2017
Author	Victor Cerbins
Customer	Jackson Labs
Boiler Model	FLX200-800, 150#
Burner Model	Profire V Series, Model LNVLG080
Design Pressure (psig)	150, ASME SECTION I; "S" Stamped
Furnace Volume (cuft)	94.6
Heating Surface (sqft)	769.9

HEAT LOSS		**100%**	**75%**	**50%**	**25%**
Dry Gas (%)		8	7.7	7	6.4
H_2 and H_2O in Fuel (%)		9.6	9.3	9.1	8.9
Radiationi & Conv (%)		0.5	0.5	0.9	1.99
Total Heat Loss (%)		18.1	17.5	17	17.29
FLOW RATES					
Gas LHV Flow Rate (Btu/SCF)		2,372	2,372	2,372	2,372
Gas HHV Flow Rate (Btu/SCF)		2,577	2,577	2,577	2,577
HHV Gas Flow Rate (SCFH)		3,029	2,252	1,502	738
Gas HHV (Btu/lb)		21,668	21,668	21,668	21,668
Gas Flow Rate (lb/hr)		360	268	179	88
Combustion Air Flow (SCFM)		1,910	1,430	960	470
Flue Gas to Stack (SCFM))		1,548	1,151	768	377
Flue Gas to Stack (ACFM))		2,914	2,131	1,354	639
RESISTANCE					
Furnace Pressure (in.W.C.)		2.5	1	0.5	0.1
HEAT RELEASE					
Furnace Heat Release (Btu/hr/cuft)		82,524	61,335	40,928	20,108
Furnace heat Release (Btu/hr/sqft)		75,065	55,792	37,229	18,291
Heat Absorption Rate (Btu/hr/sqft)		8,305	6,218	4,174	2,044
EMISSIONS, Controlled					
NOx	ppm	42	42	42	42
	lb/MMBTU	0.053	0.053	0.053	0.053
	lb/hr	0.411	0.305	0.204	0.100
CO	ppm	100	100	100	100
	lb/MMBTU	0.038	0.038	0.038	0.038
	lb/hr	2.982	2.216	1.479	0.727
S0x	ppm	0.61	0.61	0.61	0.61
	lb/MMBTU	0.0011	0.0011	0.0011	0.0011
	lb/hr	0.009	0.006	0.004	0.002
HC/VOC's	ppm	19	19	19	19
	lb/mmbtu	0.0083	0.0083	0.0083	0.0083
	lb/hr	0.065	0.048	0.032	0.016
PM (Filterable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0188	0.0188	0.0188	0.0188
	lb/hr	0.147	0.109	0.073	0.036

Boiler #3

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - Gas Fuel — Rev 1 - Corrected Fuel HHV

Project No: TBD

BACKGROUND INFORMATION

Date	3/31/2017	Page 3 of 3
Author	Victor Cerbins	
Customer	Jackson Labs	
City & State	Mass.	
Boiler Model	FLX200-800, 150#	
Burner Model	Profire V Series, Model LNVLG080	
Design Pressure (psig)	150, ASME SECTION I; "S" Stamped	
Furnace Volume (cuft)	94.6	
Heating Surface (sqft)	769.9	

		100%	75%	50%	25%
EMISSIONS, Controlled					
PM10 (Condensable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0053	0.0053	0.0053	0.0053
	lb/hr	0.041	0.031	0.021	0.010
PM2.5 (Filterable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0188	0.0188	0.0188	0.0188
	lb/hr	0.147	0.109	0.073	0.036
PM2.5 (Condensable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0053	0.0053	0.0053	0.0053
	lb/hr	0.041	0.031	0.021	0.010

PHYSICALS:(5)		Voltage: 460/3/60
DESIGN PRESSURE PSIG	150	Fan Motor @ 7-1/2 HP
UPPER DRUM	24" OD	
LOWER DRUM	10" OD	Gas Pressure @ 10 PSIG inlet.
1-1/2", 13 GAUGE WATERTUBES		Steam Operating Pressure @ 90 psig
STEAM NOZZLE CONNECTIION	6" 300# FLG	
STACK CONNECTION	18"	Safety Valve setting @ 125 psig

NOTES:

(1) Ambient air @ 80 F and 60% relative humidity

(2) Includes 1/2% mfg.'s margin, 1/2% unaccounted and ABMA radiation loss.

(3) All ppm levels are corrected to dry at 3% oxygen

(4) If any of the actual fuel constituent levels are different than indicated, the emissions will change.

(5) Emission data based on anticipated boiler efficiency.

(6) % H2O by volume in exhaust gas is 10.78%; %O2 in exhaust gas is 3.94

(7) CO2 produced is exclusive of any particulates in combustion air or other sources.

(8) Heat input is based on high heating value (HHV).

(9) Exhaust data is based on a clean and properly sealed boiler.

NOTE: Burner Turndown is 4:1 on Gas

Boiler #3

Cleaver-Brooks Boiler Expected Steam Performance Data

Uncontrolled Emissions - No.2 Oil Fuel Rev 1: Corrected oil flow gph

Project No: TBD

BACKGROUND INFORMATION

Date	2/7/2017
Author	Victor Cerbins
Customer	Jackson Lab
City & State	Mass
Boiler Model	FLX200-800
Burner Model	Profire V Series, Model LNVLG070
Design Pressure (psig)	150, ASME SECTION I; "S" Stamped
Furnace Volume (cuft)	94.6
Heating Surface (sqft)	769.9

	100%	67%	33%
ENTHALPY			
Steam Enthalpy, hg (Btu/lb)	1188	1188	1188
Feedwater Enthalpy, hfw (Btu/lb)	180	180	180
LOAD			
Operating BHP	167	112	55
Steam Flow Rate, (lb/hr)	5,380	3,618	1,777
Firing Rate	**100%**	**67%**	**33%**
Fuel Type	**No.2 Oil**	**No.2 Oil**	**No.2 Oil**
Fuel HHV (Btu/SCF) @ 19420		See Below	
EXCESS AIR			
Excess Air Leaving Boiler	25.0%	25.0%	30.0%
CO_2 Leaving Boiler	11.0%	11.0%	10.5%
PRESSURE			
Steam Operating Pressure, (psig)	80	80	80
TEMPERATURES			
Flue Gas Temp. Leaving Boiler (^oF)	505	470	440
Feedwater Temperature, T fw (^oF)	180	180	180
Combustion Air Temperature (^oF)	80	80	80
Steam Temperature (^oF)	331	331	331
ENERGY			
Heat Output, (kBtu/hr)	5,590	3,749	1,841
HHV Fuel-to-Steam Efficiency (%)	81.92	82.3	83.1
HHV Heat Input (kBtu/hr)	6,824	4,556	2,216

Boiler #3

Cleaver-Brooks Boiler Expected Steam Performance Data

Uncontrolled Emissions - No.2 Oil Fuel Rev 1: Corrected oil flow gph

Project No: TBD

BACKGROUND INFORMATION

Date	2/7/2017
Author	Victor Cerbins
Customer	Jackson Lab
Boiler Model	FLX200-800
Burner Model	Profire V Series, Model LNVLG070
Design Pressure (psig)	150, ASME SECTION I; "S" Stamped
Furnace Volume (cuft)	94.6
Heating Surface (sqft)	769.9

		100%	67%	33%
HEAT LOSS				
Dry Gas (%)		10	9.5	8.5
H_2 and H_2O in Fuel (%)		7.38	7.3	7.1
Radiation & Conv (%)		0.7	0.9	1.3
Total Heat Loss (%)		18.08	17.7	16.9
FLOW RATES				
Oil HHV (Btru/Lb)*		19,906	19,906	19,906
Oil Flow Rate (Lbs/Hr)		343	229	111
Oil HHV (Btu/Gal)		140,159	140,159	140,159
Oil Flow Rate (Gal/hr)*		49	33	16
Combustion Air Flow (SCFM)		1,670	1,120	550
Flue Gas to Stack (SCFM))		1,388	926	450
Flue Gas to Stack (ACFM))		2,652	1,706	803
RESISTANCE				
Furnace Pressure (in.W.C.)		2.5	1	0.5
HEAT RELEASE				
Furnace Heat Release (Btu/hr/cuft)		72,137	48,156	23,420
Furnace heat Release (Btu/hr/sqft)		65,617	43,803	21,303
Heat Absorption Rate (Btu/hr/sqft)		7,261	4,870	2,391
EMISSIONS, UnControlled				
NOx	ppm	150	150	150
	lb/MMBTU	0.200	0.200	0.200
	lb/hr	1.365	0.911	0.443
CO	ppm	50	50	50
	lb/MMBTU	0.039	0.039	0.039
	lb/hr	0.000	0.000	0.000
S0x	ppm	271	271	271
	lb/MMBTU	0.502	0.502	0.502
	lb/hr	3.425	2.286	1.112
HC/VOC's	ppm	4	4	4
	lb/mmbtu	0.03	0.03	0.03
	lb/hr	0.205	0.137	0.066
PM	ppm	NA	NA	NA
	lb/mmbtu	0.02	0.02	0.02
	lb/hr	0.136	0.091	0.044

Boiler #3

Cleaver-Brooks Boiler Expected Steam Performance Data

Uncontrolled Emissions - No.2 Oil Fuel Rev 1: Corrected oil flow gph

Project No: TBD

BACKGROUND INFORMATION

Date	2/7/2017	Page 3 of 3
Author	Victor Cerbins	
Customer	Jackson Lab	
City & State	Mass	
Boiler Model	FLX200-800	
Burner Model	Profire V Series, Model LNVLG070	
Design Pressure (psig)	150, ASME SECTION I; "S" Stamped	
Furnace Volume (cuft)	94.6	
Heating Surface (sqft)	769.9	

PHYSICALS:(5)

DESIGN PRESSURE PSIG	150	Max. steam flow rate @ 5595 pph
UPPER DRUM	24" OD	at 228 F inlet feedwater.
LOWER DRUM	10" OD	Gas Pressure @ 10 PSIG inlet.
1-1/2", 13 GAUGE WATERTUBES		Steam Operating Pressure @ 90 psig
STACK CONNECTION	18"	

NOTES:

(1) Ambient air @ 80 F and 60% relative humidity

(2) Includes 1/2% mfg.'s margin, 1/2% unaccounted and ABMA radiation loss.

(3) All ppm levels are corrected to dry at 3% oxygen

Oil Emissions levels are based on the following fuel constituent levels:

Ash Content: 0.0100% by weight.

Conradson Carbon Residue: 0.3500% by weight

Fuel Bound Nitrogen Content: 0.01500% by Weight

Sulfur Content: 0.0015% by weight.

(4) If any of the actual fuel constituent levels are different than indicated, the emissions will change.

(5) Emission data based on anticipated boiler efficiency.

(6) % H_2O by volume in exhaust gas is 10.78%; %O_2 in exhaust gas is 3.94

(7) CO_2 produced is exclusive of any particulates in combustion air or other sources.

(8) Heat input is based on high heating value (HHV).

(9) Exhaust data is based on a clean and properly sealed boiler.

* - Oil flow given is the burn rate, suction capacity of the pump is greater and must be considered for line sizing.

Burner TD is 3:1

Boiler #1 and Boiler #2

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - No. 2 Fuel Oil
Project No: TBD

BACKGROUND INFORMATION

Date	1/12/2017	Page 1 of 3
Author	Victor Cerbins	
Customer	Jackson Lab	
	Mass	
Boiler Model	FLX200-2500, 150#	
Burner Model	ProFire Series, Model LNEVLG250	
Design Pressure (psig)	150# ASME Section I Steam	
Furnace Volume (cuft)	447	
Heating Surface (sqft)	2606.6	

FIRING RATE	**100%**	**75%**	**50%**	**25%**
Fuel Type	**# 2 Oil**	**# 2 Oil**	**# 2 Oil**	**# 2 Oil**
ENTHALPY				
Steam Enthalpy, hg (Btu/lb)	1188	1188	1188	1188
Water Enthalpy, hfw (Btu/lb)	180	180	180	180
LOAD				
Operating BHP	600	450	300	150
Steam Flow Rate, (lbm/hr)	19,925	14,944	9,963	4,981
%Continuous Blowdown	0	0	0	0
Continuous Blowdown (lbm/hr)	0	0	0	0
EXCESS AIR				
Excess Air Leaving Boiler	25.0%	25.0%	30.0%	35.0%
O2 Leaving Boiler	4,4%	4.4%	5.0%	5.7%
CO_2 Leaving Boiler	12.0%	12.0%	11.5%	11.0%
PRESSURE				
Steam Operating Pressure (PSIG)	90	90	90	90
TEMPERATURES				
Flue Gas Temp. Leaving Boiler (^oF)	475	455	430	390
Water Entering Boiler Temp (^oF)	212	212	212	212
Combustion Air Temperature (^oF)	80	80	80	80
Steam Temperature Leaving Boiler (^oF)	331	331	331	331
ENERGY				
Heat Output, (kBtu/hr)	20,085	15,063	10,042	5,021
HHV Fuel-to-Steam Efficiency (%)	84.94	85.47	85.98	85.68
HHV Heat Input (kBtu/hr)	23,646	17,624	11,679	5,860

Boiler #1 and Boiler #2

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - No. 2 Fuel Oil
Project No. TBD

BACKGROUND INFORMATION

Date	1/12/2017
Author	Victor Cerbins
Customer	Jackson Lab
Boiler Model	FLX200-2500, 150#
Burner Model	ProFire Series, Model LNEVLG250
Design Pressure (psig)	150# ASME Section I Steam
Furnace Volume (cuft)	447
Heating Surface (sqft)	2606.6

HEAT LOSS		**100%**	**75%**	**50%**	**25%**
Dry Gas (%)		7.59	7.04	6.5	6.18
H_2 and H_2O in Fuel (%)		7.08	7.01	6.94	6.87
Moisture in Air (%)		0.09	0.08	0.08	0.07
Radiation & Conv (%)		0.3	0.4	0.5	1.2
Total Heat Loss (%)		15.06	14.53	14.02	14.32
FLOW RATES					
Oil HHV (Btu/Lb)		19,906	19,906	19,906	19,906
Oil Flow Rate (Lbs/Hr)		1,188	885	587	294
Oil Flow Rate (Btu/Gal)		140,000	140,000	140,000	140,000
Oil Flow Rate (Gal/Hr)		169	126	83	42
Dry Air Weight (lb/lb fuel)		19	19	19	19
Combustion Air Flow (SCFM)		6500	4100	3200	1650
Flue Gas to Stack (SCFM))		4808	3583	2375	1192
Flue Gas to Stack (ACFM))		8905	6495	4187	2006
RESISTANCE					
Furnace Pressure (in.W.C.)		5.5	4	1	0.1
Burner Pressure (in.W.C.)		24.8	11	0.5	0.3
Total Pressure (in. W.C.)		30.3	15	1.5	0.4
HEAT RELEASE					
Furnace Heat Release (Btu/hr/cuft)		52,900	39,427	26,129	13,110
Furnace Heat Release (Btu/hr/sqft)		78,040	89,917	59,589	29,899
Heat Absorption Rate (Btu/hr/sqft)		7,705	5,779	3,853	1,926
EMISSIONS, Controlled					
NOx	ppm	90	90	90	90
	lb/MMBTU	0.106	0.106	0.106	0.106
	lb/hr	0.003	0.002	0.001	0.001
CO	ppm	50	50	50	50
	lb/MMBTU	0.036	0.036	0.036	0.036
	lb/hr	0.001	0.001	0.000	0.000
S0x	ppm	0.4	0.4	0.4	0.4
	lb/MMBTU	0.0006	0.0006	0.0006	0.0006
	lb/hr	0.000	0.000	0.000	0.000
HC/VOC's	ppm	10	10	10	10
	lb/mmbtu	0.016	0.016	0.016	0.016
	lb/hr	0.000	0.000	0.000	0.000
PM10 (Filterable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0008	0.0008	0.0008	0.0008
	lb/hr	0.019	0.014	0.009	0.005

Boiler #1 and Boiler #2

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - No. 2 Fuel Oil
Project No. TBD

BACKGROUND INFORMATION

Date	1/12/12017	Page 3 of 3
Author	Victor Cerbins	
Customer	Jackson Lab	
Boiler Model	FLX200-2500, 150#	
Burner Model	ProFire Series, Model LNEVLG250	
Design Pressure (psig)	150# ASME Section I Steam	
Furnace Volume (cuft)	447	
Heating Surface (sqft)	2606.6	

EMISSIONS, Controlled		100%	75%	50%	25%
PM10 (Condensable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0096	0.0096	0.0096	0.0096
	lb/hr	0.227	0.169	0.112	0.056
PM2.5 (Filterable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0008	0.0008	0.0008	0.0008
	lb/hr	0.019	0.014	0.009	0.005
PM2.5 (Condensable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0096	0.0096	0.0096	0.0096
	lb/hr	0.227	0.169	0.112	0.056

PHYSICALS:(5)		
DESIGN PRESSURE PSIG	150	Voltage: 460/3/60
UPPER DRUM	32"OD	Fan Motor @ 25 HP
LOWER DRUM	12" OD	Air Compressor Motor @ 7.5 HP
		Oil Metering Pump Motor @ 3/4 HP
		Remote Oil Pump Motor @ 1/2 HP
2" OD, 0.095 WALL WATERTUBES		Safety Valves: 2@2-1/2"
STEAM NOZZLE CONNECTION	8" 300# FLG	Safety Valve Setting: 150#
STACK CONNECTION	24"	Boiler Steam Pressure Gauge: 6" Dial

NOTES:
(1) Ambient air @ 80 F and 60% relative humidity
(2) Includes 1/2% mfg.'s margin, 1/2% unaccounted and ABMA radiation loss.
(3) All ppm levels are corrected to dry at 3% oxygen
Oil Emissions levels are based on the following fuel constituent levels:
Ash Content: 0.0100% by weight.
Conradson Carbon Residue: 0.3500% by weight
Fuel Bound Nitrogen Content: 0.01500% by Weight
Sulfur Content: 0.0015% by weight.
(4) If any of the actual fuel constituent levels are different than indicated, the emissions will change.
(5) Emission data based on anticipated boiler efficiency.
(6) % H2O by volume in exhaust gas is 10.78%; %O2 in exhaust gas is 3.94
(7) CO2 produced is exclusive of any particulates in combustion air or other sources.
(8) Heat input is based on high heating value (HHV).
(9) Exhaust data is based on a clean and properly sealed boiler.

Boiler #1 and Boiler #2

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - Propane Gas
Project No: TBD

BACKGROUND INFORMATION

Date	1/12/2017	Page 1 of 3
Author	Victor Cerbins	
Customer	Jackson Labs Mass.	
Boiler Model	FLX200-2500, 150#	
Burner Model	ProFire Series, Model LNEVLG250	
Design Pressure (psig)	150# ASME Section I Steam	
Furnace Volume (cuft)	447	
Heating Surface (sqft)	2606.6	

FIRING RATE	**100%**	**75%**	**50%**	**25%**
Fuel Type	**Propane**	**Propane**	**Propane**	**Propane**
ENTHALPY				
Steam Enthalpy, hg (Btu/lb)	1188	1188	1188	1188
Water Enthalpy, hfw (Btu/lb)	180	180	180	180
LOAD				
Operating BHP	600	450	300	150
Steam Flow Rate, (lbm/hr)	19,925	14,945	9,963	4,981
%Continuous Blowdown	0	0	0	0
Continuous Blowdown (lbm/hr)				
EXCESS AIR				
Excess Air Leaving Boiler	20.0%	20.0%	25.0%	35.0%
O2 Leaving Boiler	3.8%	3.8%	4.0%	5.8%
CO_2 Leaving Boiler	10.0%	9.8%	9.6%	9.0%
PRESSURE				
Steam Operating Pressure (PSIG)	90	90	90	90
TEMPERATURES				
Flue Gas Temp. Leaving Boiler (^oF)	474	445	415	390
Water Entering Boiler Temp (^oF)	212	212	212	212
Combustion Air Temperature (^oF)	80	80	80	80
Steam Temperature Leaving Boiler (^oF)	331	331	331	331
ENERGY				
Heat Output, (kBtu/hr)	20,085	15,063	10,042	5,021
HHV Fuel-to-Steam Efficiency (%)	83.57	83.98	84.36	83.17
HHV Heat Input (kBtu/hr)	24,034	17,936	11,904	6,037

Boiler #1 and Boiler #2

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - Propane Gas
Project No. TBD

BACKGROUND INFORMATION

Date	1/12/2017
Author	Victor Cerbins
Customer	Jackson Lab
Boiler Model	FLX200-2500, 150#
Burner Model	ProFire Series, Model LNEVLG250
Design Pressure (psig)	150# ASME Section I Steam
Furnace Volume (cuft)	447
Heating Surface (sqft)	2606.6

HEAT LOSS		**100%**	**75%**	**50%**	**25%**
Dry Gas (%)		6.84	6.34	5.85	6.32
H_2 and H_2O in Fuel (%)		9.2	9.1	9.02	8.93
Moisture in Air (%)		0.09	0.08	0.07	0.08
Radiation & Conv (%)		0.3	0.5	0.7	1.5
Total Heat Loss (%)		16.43	16.02	15.64	16.83
FLOW RATES					
Gas LHV Flow Rate (Btu/SCF)		2,372	2,372	2,372	2372
Gas HHV (Btu/SCF)		2,577	2,577	2,755	2,577
HHV Gas Flow Rate (SCFH)		9,326	6,960	4,321	2,343
Gas HHV (Btu/lb)		21,668	21,668	21,668	21,668
Gas Flow Rate (lb/hr)		1,109	828	549	279
Combustion Air Flow (SCFM)		5400	4050	2700	1350
Flue Gas to Stack (SCFM))		4767	3557	2361	1197
Flue Gas to Stack (ACFM))		8819	6377	4092	2016
RESISTANCE					
Furnace Pressure (in.W.C.)		5.5	4	0.2	0.1
Burner Pressure (in.W.C.)		24.8	15	0.7	0.3
Total Pressure (in. W.C.)		30.3	19	0.9	0.4
HEAT RELEASE					
Furnace Heat Release (Btu/hr/cuft)		53,767	40,126	26,630	13,506
Furnace Heat Release (Btu/hr/sqft)		79,319	91,512	60,733	30,801
Heat Absorption Rate (Btu/hr/sqft)		7,705	5,779	3,853	1,926
EMISSIONS, Controlled					
NOx	ppm	42	42	42	42
	lb/MMBTU	0.049	0.049	0.049	0.049
	lb/hr	1.188	0.886	0.588	0.298
CO	ppm	100	100	100	100
	lb/MMBTU	0.073	0.073	0.073	0.073
	lb/hr	1.754	1.309	0.869	#NAME?
S0x	ppm	0.61	0.61	0.61	0.61
	lb/MMBTU	0.0011	0.0011	0.0011	0.0011
	lb/hr	0.026	0.020	0.013	0.007
HC/VOC's	ppm	19	19	19	19
	lb/mmbtu	0.0083	0.0083	0.0083	0.0083
	lb/hr	0.199	0.149	0.099	0.050
PM10 (Filterable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0188	0.0188	0.0188	0.0188
	lb/hr	0.452	0.337	0.224	0.113

Boiler #1 and Boiler #2

Cleaver-Brooks Boiler Expected Steam Performance Data

Controlled Emissions - Propane Gas
Project No. TBD

BACKGROUND INFORMATION

Date	1/12/2017	Page 3 of 3
Author	Victor Cerbins	
Customer	Jackson Lab	
Boiler Model	FLX200-2500, 150#	
Burner Model	ProFire Series, Model LNEVLG250	
Design Pressure (psig)	150# ASME Section I Steam	
Furnace Volume (cuft)	447	
Heating Surface (sqft)	2606.6	

EMISSIONS, Controlled		100%	75%	50%	25%
PM10 (Condensable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0053	0.0053	0.0053	0.0053
	lb/hr	0.127	0.095	0.063	0.032
PM2.5 (Filterable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0188	0.0188	0.0188	0.0188
	lb/hr	0.452	0.337	0.224	0.113
PM2.5 (Condensable)	ppm	NA	NA	NA	NA
	lb/mmbtu	0.0053	0.0053	0.0053	0.0053
	lb/hr	0.127	0.095	0.063	0.032

PHYSICALS:(5)			
DESIGN PRESSURE	PSIG	150	Voltage: 460/3/60
UPPER DRUM		32"OD	Fan Motor @ 25 HP
LOWER DRUM		12" OD	Gas Pressure @ 5 psig
2" OD, 0.095 WALL WATERTUBES			Safety Valves: 2@2-1/2"
STEAM NOZZLE CONNECTION		8" 300# FLG	Safety Valve Setting: 150#
STACK CONNECTION		24"	Boiler Steam Pressure Gauge: 6" Dial

NOTES:
(1) Ambient air @ 80 F and 60% relative humidity
(2) Includes 1/2% mfg.'s margin, 1/2% unaccounted and ABMA radiation loss.
(3) All ppm levels are corrected to dry at 3% oxygen
(4) If any of the actual fuel constituent levels are different than indicated, the emissions will change.
(5) Emission data based on anticipated boiler efficiency.
(6) % H2O by volume in exhaust gas is 10.78%; %O2 in exhaust gas is 3.94
(7) CO2 produced is exclusive of any particulates in combustion air or other sources.
(8) Heat input is based on high heating value (HHV).
(9) Exhaust data is based on a clean and properly sealed boiler.

APPENDIX G: GENERATOR SPECIFICATION SHEETS

2017 EPA Tier 2 Exhaust Emission Compliance Statement
1250DQGAA
Stationary Emergency
60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with Tier 2 emissions limit of U.S. EPA New Source Performance Standards for stationary emergency engines under the provisions of 40 CFR 60 Subpart IIII when tested per ISO8178 D2.

Engine Manufacturer:	Cummins Inc
EPA Certificate Number:	HCEXL050.AAD-024
Effective Date:	11/15/2016
Date Issued:	11/15/2016
EPA Engine Family (Cummins Emissions Family):	HCEXL050.AAD (D283)

Engine Information:

Model:	QSK50 / QSK50-G / QSK50-G4 NR2	Bore:	6.25 in. (159 mm)
Engine Nameplate HP:	2220	Stroke:	6.25 in. (159 mm)
Type:	4 Cycle, 60°V, 16 Cylinder Diesel	Displacement:	3067 cu. in. (50.3 liters)
Aspiration:	Turbocharged and CAC	Compression Ratio:	15.0:1
Emission Control Device:	Electronic Control	Exhaust Stack Diameter:	2 - 10 in.

Diesel Fuel Emission Limits

D2 Cycle Exhaust Emissions

	Grams per BHP-hr			Grams per kWm-hr		
	NOx + NMHC	CO	PM	NOx + NMHC	CO	PM
Test Results - Diesel Fuel (300-4000 ppm Sulfur)	4.6	0.9	0.06	6.1	1.2	0.08
EPA Emissions Limit	4.8	2.6	0.15	6.4	3.5	0.20
Test Results - CARB Diesel Fuel (<15 ppm Sulfur)	4.2	0.9	0.05	5.6	1.2	0.07
CARB Emissions Limit	4.8	2.6	0.15	6.4	3.5	0.20

The CARB emission values are based on CARB approved calculations for converting EPA (500 ppm) fuel to CARB (15 ppm) fuel.
Test Methods: EPA/CARB Nonroad emissions recorded per 40CFR89 (ref. ISO8178-1) and weighted at load points prescribed in Subpart E, Appendix A for Constant Speed Engines (ref. ISO8178-4, D2)

Diesel Fuel Specifications: Cetane Number: 40-48. Reference: ASTM D975 No. 2-D.
Reference Conditions: Air Inlet Temperature: 25°C (77°F), Fuel Inlet Temperature: 40°C (104°F). Barometric Pressure: 100 kPa (29.53 in Hg), Humidity: 10.7 g/kg (75 grains H2O/lb) of dry air; required for NOx correction, Restrictions: Intake Restriction set to a maximum allowable limit for clean filter; Exhaust Back Pressure set to a maximum allowable limit.

Tests conducted using alternate test methods, instrumentation, fuel or reference conditions can yield different results.
Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

Exhaust Emission Data Sheet
1250DQGAA
60 Hz Diesel Generator Set

Engine Information:

Model:	Cummins Inc QSK50-G4 NR2	Bore:	6.25 in. (159 mm)
Type:	4 Cycle, 60°V, 16 Cylinder Diesel	Stroke:	6.25 in. (159 mm)
Aspiration:	Turbocharged and Low Temperature Aftercooled	Displacement:	3067 cu. In. (50.2 liters)
Compression Ratio:	15.0:1		
Emission Control Device:	Turbocharged and Low Temperature Aftercooled		

	1/4	1/2	3/4	Full	Full
PERFORMANCE DATA	**Standby**	**Standby**	**Standby**	**Standby**	**Prime**
BHP @ 1800 RPM (60 Hz)	462.5	925	1387.5	1850	1628
Fuel Consumption (gal/Hr)	29.1	49	69.5	90.5	81.0
Exhaust Gas Flow (CFM)	4298.6	6623	8659	10983.5	9707.0
Exhaust Gas Temperature (°F)	627.3	692.3	727	840	743.0
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	0.46	0.23	0.15	0.09	0.11
NOx (Oxides of Nitrogen as NO2)	3.72	3.79	4.16	4.82	4.25
CO (carbon Monoxide)	1.31	0.66	0.42	0.4	0.32
PM (Particular Matter)	0.27	0.13	0.06	0.02	0.03
SO2 (Sulfur Dioxide)	0.01	0.01	0.01	0.01	0.01
Smoke (Bosch)	0.64	0.43	0.24	0.13	0.14
All values are Grams per HP-Hour, Smoke is Bosch#					

TEST CONDITIONS

Data is representative of steady-state engine speed (± 25 RPM) with full load (± 2%). Pressures, temperatures, and emission rates were stabilized.

Fuel Specification:	ASTM D975 No. 2-D diesel fuel with ULSD, and 40-48 cetane number
Fuel Temperature:	99 ± 9 °F (at fuel pump inlet)
Intake Air Temperature:	77 ± 9 °F
Barometric Pressure:	29.6 ± 1 in. Hg
Humidity:	NOx measurement corrected to 75 grains H2O/lb dry air
Reference Standard:	ISO 8178

The NOx, HC, CO and PM emission data tabulated here are representative of test data taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may results in elevated emission levels.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2017 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **Cummins Inc.**
(U.S. Manufacturer or Importer)

Certificate Number: HCEXL050.AAD-024

Effective Date: 11/15/2016

Expiration Date: 12/31/2017

Byron J. Bunker, Division Director
Compliance Division

Issue Date: 11/15/2016

Revision Date: N/A

Model Year: 2017
Manufacturer Type: Original Engine Manufacturer
Engine Family: HCEXL050.AAD

Mobile/Stationary Indicator: Stationary
Emissions Power Category: 560<kW<=2237
Fuel Type: Diesel
After Treatment Devices: No After Treatment Devices Installed
Non-after Treatment Devices: Electronic Control

Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Part 60, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 60.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

The actual engine power may lie outside the limits of the Emissions Power Category shown above. See the certificate application for details.

APPENDIX H: STERILIZER SPECIFICATION SHEETS

3M Science. Applied to Life.™

Specifications

3M™ Steri-Vac™ Sterilizer/Aerator GS Series

3M™ Steri-Vac™ Sterilizer/Aerator GS Series is a 100% ethylene oxide sterilization system that is an effective and safe low temperature sterilization method for medical devices and other applications. The GS Series sterilizers, Models GS5 and GS8 are designed for use in health care, and Models GS5X and GS8X for use in life science, medical device, contract sterilization, R&D laboratory applications, and other research and industrial applications for terminal sterilization. The GS Series sterilizers provide control and independent monitoring with state-of-the-art, compliant mechanical design.

			Models GS5 and GS5X	Models GS8 and GS8X
Dimensions and Weight	Shipping Weight	Single Door	163 kg (359 lbs.)	355 kg (782 lbs.)
		Double Door	169 kg (373 lbs.)	362 kg (799 lbs.)
	Operational Weight	Single Door	127 kg (281 lbs.)	261 kg (576 lbs.)
		Double Door	132 kg (290 lbs.)	269 kg (593 lbs.)
	Exterior Dimensions H x W x D		70.9×76.2×95.0 cm (27.9×30.0×37.4 in.)	179.8×94.0×109.0 cm (70.8×37.0×42.9 in.)
Sterilization Chamber	Volume		136 L (4.8 ft³)	224 L (7.9 ft³)
	Dimensions H x W x D		38.0×43.0×83.0 cm (15.0×17.0×32.5 in.)	46.0×51.0×97.0 cm (18.0×20.0×38.0 in.)
	Load Basket Dimensions W x L x H	Lower Basket:	39.0×80.0×18.0 cm (15.5×31.5×7.0 in.)	45.7×94.0×20.0 cm (18×37×8.0 in.)
		Upper Basket:	39.0×80.0×18.0 cm (15.5×31.5×7.0 in.)	47.0×47.0×20.0 cm (18.5×18.5×8.0 in.)
Sound	Sound Levels		The average decibel level of an active sterilizer is <60 dBA*	
Electrical Power	Voltage Range		200–240 VAC	
	Frequency		50/60 Hz	
	Phase		Single	
	Current		15 amp dedicated circuit	
	Heat Load		5500 Btu/hr	6150 Btu/hr
	Internal Circuit Breaker		7 amp	12 amp
Environmental Operating Conditions	Altitude		2500 M (maximum)	
	Operating Temperature		15–35°C	
	Humidity		20–80% relative humidity (non-condensing)	
	Room Air Exchanges		10 per hour (minimum)	
	Minimum Room Size		30 m³ (1000 ft³)	
Compressed Air Specifications	Pressure		7.0 kg/cm² (100 psig) minimum to 10.5 kg/cm² (150 psig) maximum	
	Flow Rate		2.2 liters per second at 5.6 kg/cm² (4.7 cubic feet per minute at 80 psig) per sterilizer, 100% duty cycle compressor	
	Quality		Clean air supply with a maximum allowable dirt particle size of 0.5 microns and free of oil	
	Moisture Content		Less than 10°C (50°F) dew point	
Required Service Access	Minimum distance from rear wall		10.2 cm (4 in.)**	
	Minimum access on both sides and top		51 cm (20 in.)	
	Service Footprint H × W × D		122 × 177.8 × 146 (47.9 × 70.0 × 57.4)	231 × 196 × 160 (40.8 × 77.0 × 62.9)
Ethylene Oxide Storage Requirements	Cabinet		Approved flammable liquid storage cabinet	
	Venting		Vented to outside or to a non-recirculating, continuously operating, dedicated exhaust system, 10 air exchanges per hour required in cabinet	
	Size		Volume to hold two months' supply	

* Contact 3M for more information.
**If the sterilizer is able to be moved for servicing, otherwise 51 cm (20 in.) is required.

Additional site planning information is available in the 3M™ Steri-Vac™ Sterilizer/Aerator GS Series Site Planning & Installation Guide.

Specifications

3M™ EO Abator

The 3M™ EO Abator is a highly effective device used to catalytically convert 100% ethylene oxide gas exhausted from the 3M™ Steri-Vac™ Sterilizer/Aerators GS and GSX Series to CO_2 and water vapor. At normal operating conditions, removal efficiency is 99.9+% (when EO is >100 ppm), virtually eliminating emissions to meet environmental requirements. The 3M EO Abator is designed exclusively for use with 3M™ Steri-Vac™ Sterilizer/Aerators GS and GSX Series.

	3M™ EO Abator	
Physical Dimensions		
Width	900 mm (36 in.)	
Height	800 mm (31.5 in.)	
Depth	1050 mm (41.5 in.)	
Weight	Operating: 155.6 kg (343 lbs) Shipping: 245.8kg (542lbs)	
Sound Levels	<85 dBA	
Electrical Power Requirements		
Frequency	50–60 Hz	
Installation/Over Voltage Category	Category II	
Distance from earth ground to Abator	<40 m (130 ft)	
Model	**Voltage**	**Current**
Model 50 AN (US/Canada)	220-240V Single Phase Volts AC	30 Amps
Model 50AE (Europe)	400V (±10%), Three Phase Volts AC	17 Amps
Model 50AJ (Japan)	200V (±10%), Three Phase Volts AC	28 Amps
Required Environmental Operating Conditions		
Altitude	≤ 2500 meters	
Relative Humidity	20 – 80 % (non-condensing)	
Operating Temperature	0–49°C	
Exhaust Temperature	Idle (Ready): 138°C (280°F) Normal: 238°C Maximum: 260°C	
Abator Operating Parameters		
Pollution Degree	2	
Heat Source	6 kW Electric Duct Heater	
Maximum Air Flow	1.4 NCMM (50 SCFM)	
Maximum EO Feed Rate	7.7 g/min (0.017 lbs/min)	
Required Service Access		
Service Footprint (H × W × D)	171.45 × 193.04 × 166.37 cm (67.5 × 76 × 65.5 in.)	
Top/above unit	900 mm (36 in.)	
Left and right sides	500 mm (20 in.)	
Front side	500 mm (20 in.)	
Back side	100 mm (4 in.)	

Requirements for Length and Diameter of Vent Line for EO inlet

Number of Sterilizers connected to Abator	Length <31 m (100 ft)	31 m (100 ft) ≤ length, 61 m (200 ft)	31 m (100 ft) ≤ length <61 m (200 ft)
1	2.5 cm (1.0 in.)		
2***	2.5 cm (1.0 in.)	3.8 cm (1.5 in.)	3.8 cm (1.5 in.)

***Note: The XL Series sterilizer **cannot** be combined with a GS/GSX Series sterilizer when connecting two sterilizers to one abator.

For more information, U.S. customers contact the
3M Health Care Service Group Helpline: 1-800-292-6298.

Outside of the U.S., contact your local 3M office. See www.3M.com for office locations.

Infection Prevention Division
3M Health Care
2510 Conway Avenue
St. Paul, MN 55144-1000 USA
800-228-3957
www.3M.com/infectionprevention

Safety Data Sheet

Document Group:	10-3495-8	**Version Number:**	55.00
Issue Date:	02/19/14	**Supercedes Date:**	11/22/13

SECTION 1: Identification

1.1. Product identifier
STERI-GAS BRAND CARTRIDGES 4-60, 4-100, 4-134, and 8-170

Product Identification Numbers
70-2007-2768-6, 70-2007-4128-1, 70-2007-4129-9, 70-2007-4130-7, 70-2007-4132-3, 70-2007-4133-1, 70-2007-4134-9, 70-2007-4135-6, 70-2007-4136-4, 70-2007-4137-2, 70-2007-4138-0, 70-2007-4140-6, 70-2007-4142-2, 70-2007-7124-7, 70-2007-7125-4, 70-2007-8376-2, 70-2007-8377-0, 70-2007-8378-8, 70-2007-8379-6, 70-2007-8380-4, 70-2007-8381-2, 70-2007-8382-0, 70-2007-8383-8, 70-2007-8384-6, 70-2007-8385-3

1.2. Recommended use and restrictions on use

Recommended use
Gas to sterilize in a 3M Steri-Vac(TM) Ethylene Oxide Sterilizer

1.3. Supplier's details

MANUFACTURER:	3M
DIVISION:	Infection Prevention Division
ADDRESS:	3M Center, St. Paul, MN 55144-1000, USA
Telephone:	1-888-3M HELPS (1-888-364-3577)

1.4. Emergency telephone number
1-800-364-3577 or (651) 737-6501 (24 hours)

SECTION 2: Hazard identification

2.1. Hazard classification
Flammable Gas: Category 1.
Gas Under Pressure: Liquefied gas.
Acute Toxicity (inhalation): Category 3.
Serious Eye Damage/Irritation: Category 2A.
Skin Corrosion/Irritation: Category 2.
Reproductive Toxicity: Category 2.
Carcinogenicity: Category 1A.
Germ Cell Mutagenicity: Category 1B.
Specific Target Organ Toxicity (single exposure): Category 1.
Specific Target Organ Toxicity (central nervous system): Category 3.
Specific Target Organ Toxicity (repeated exposure): Category 1.

2.2. Label elements
Signal word
Danger

Symbols
Flame | Gas cylinder | Skull and crossbones | Exclamation mark | Health Hazard |

Pictograms

Hazard Statements
Extremely flammable gas.
Contains gas under pressure; may explode if heated.

Toxic if inhaled.
Causes serious eye irritation.
Causes skin irritation.
May cause drowsiness or dizziness.
Suspected of damaging fertility or the unborn child.
May cause cancer.
May cause genetic defects.

Causes damage to organs:
respiratory system |

Causes damage to organs through prolonged or repeated exposure:
nervous system |

kidney/urinary tract |
sensory organs |

Precautionary Statements

Prevention:
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Do not breathe dust/fume/gas/mist/vapors/spray.
Use only outdoors or in a well-ventilated area.
Wear protective gloves and eye/face protection.
Do not eat, drink or smoke when using this product.
Wash thoroughly after handling.

Response:
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.
Continue rinsing.
If eye irritation persists: Get medical advice/attention.
IF ON SKIN: Wash with plenty of soap and water.
If skin irritation occurs: Get medical advice/attention.
Take off contaminated clothing and wash it before reuse.
IF exposed or concerned: Get medical advice/attention.

Call a POISON CENTER or doctor/physician.
Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
Eliminate all ignition sources if safe to do so.

Storage:
Protect from sunlight. Store in a well-ventilated place.
Keep container tightly closed.
Store locked up.

Disposal:
Dispose of contents/container in accordance with applicable local/regional/national/international regulations.

Notes to Physician:
Not applicable

2.3. Hazards not otherwise classified
May cause frostbite.

SECTION 3: Composition/information on ingredients

Ingredient	C.A.S. No.	% by Wt
ETHYLENE OXIDE	75-21-8	100

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation:
Remove person to fresh air. Get medical attention.

Skin Contact:
Immediately wash with soap and water. Remove contaminated clothing and wash before reuse. If signs/symptoms develop, get medical attention.

Eye Contact:
Immediately flush with large amounts of water for at least 15 minutes. Remove contact lenses if easy to do. Continue rinsing. Immediately get medical attention.

If Swallowed:
Rinse mouth. Do not induce vomiting. Get immediate medical attention.

4.2. Most important symptoms and effects, both acute and delayed
See Section 11.1. Information on toxicological effects.

4.3. Indication of any immediate medical attention and special treatment required
Not applicable

SECTION 5: Fire-fighting measures

5.1. Suitable extinguishing media
Refer to other precautionary advice in SDS section 5.

5.2. Special hazards arising from the substance or mixture
Closed containers exposed to heat from fire may build pressure and explode.

Hazardous Decomposition or By-Products

Substance	Condition
Carbon monoxide	During Combustion
Carbon dioxide	During Combustion

5.3. Special protective actions for fire-fighters
Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Evacuate area. Eliminate all ignition sources if safe to do so. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Ventilate the area with fresh air. Refer to other sections of this SDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment.

6.2. Environmental precautions
Avoid release to the environment.

6.3. Methods and material for containment and cleaning up
If possible, seal leaking container. Place leaking containers in a well-ventilated area, preferably an operating exhaust hood, or if necessary outdoors on an impermeable surface until appropriate packaging for the leaking container or its contents is available. Dispose of collected material as soon as possible.

SECTION 7: Handling and storage

7.1. Precautions for safe handling
For industrial or professional use only. Do not use in a confined area with minimal air exchange. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Take precautionary measures against static discharge. Do not breathe dust/fume/gas/mist/vapors/spray. Do not get in eyes, on skin, or on clothing. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Avoid release to the environment. Eliminate all ignition sources if safe to do so. Avoid contact with oxidizing agents (eg. chlorine, chromic acid etc.) Use personal protective equipment (gloves, respirators, etc.) as required. Recommendations for storing Steri-Gas cartridges are stringent. Check your local fire protection codes for additional requirements. Keep all sources of ignition such as matches, lighted cigarettes, sparks and static discharge away from the sterilzer and cartridges. Store cartridges in an upright position. Keep only one day's requirement or a maximum of twelve(12) cartridges (one box) in the immediate sterilizer area. This area needs to have at least ten air changes per hour. Additional Steri-Gas cartridges should be stored in an approved flammable liquid storage cabinet vented to the outside atmosphere, or in an area suitable for storage of flammable liquids appropriately vented to the outside atmosphere, or into a non-recirculating, continuously operating, dedicated exhaust system.

7.2. Conditions for safe storage including any incompatibilities
Store in a well-ventilated place. Keep container tightly closed. Protect from sunlight. Store away from heat. Store away from acids. Store away from oxidizing agents. Store away from areas where product may come into contact with food or pharmaceuticals.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

Ingredient	C.A.S. No.	Agency	Limit type	Additional Comments

ETHYLENE OXIDE	75-21-8	Manufacturer determined	STEL:5 ppm	
ETHYLENE OXIDE	75-21-8	Amer Conf of Gov. Indust. Hyg.	TWA:1 ppm	
ETHYLENE OXIDE	75-21-8	US Dept of Labor - OSHA	TWA:1 ppm;STEL:5 ppm	29 CFR 1910.1047

Amer Conf of Gov. Indust. Hyg. : American Conference of Governmental Industrial Hygienists
American Indust. Hygiene Assoc : American Industrial Hygiene Association
Chemical Manufacturer Rec Guid : Chemical Manufacturer's Recommended Guidelines
US Dept of Labor - OSHA : United States Department of Labor - Occupational Safety and Health Administration
TWA: Time-Weighted-Average
STEL: Short Term Exposure Limit
CEIL: Ceiling

8.2. Exposure controls

8.2.1. Engineering controls
Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below relevant Exposure Limits and/or control dust/fume/gas/mist/vapors/spray. If ventilation is not adequate, use respiratory protection equipment.

8.2.2. Personal protective equipment (PPE)

Eye/face protection

Select and use eye/face protection to prevent contact based on the results of an exposure assessment. The following eye/face protection(s) are recommended:
Indirect Vented Goggles

Skin/hand protection
Select and use gloves and/or protective clothing approved to relevant local standards to prevent skin contact based on the results of an exposure assessment. Selection should be based on use factors such as exposure levels, concentration of the substance or mixture, frequency and duration, physical challenges such as temperature extremes, and other use conditions. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible gloves/protective clothing.
Gloves made from the following material(s) are recommended: Butyl Rubber

Respiratory protection

An exposure assessment may be needed to decide if a respirator is required. If a respirator is needed, use respirators as part of a full respiratory protection program. Based on the results of the exposure assessment, select from the following respirator type(s) to reduce inhalation exposure:
Full facepiece supplied-air respirator

For questions about suitability for a specific application, consult with your respirator manufacturer.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

General Physical Form:	Gas
Specific Physical Form:	Compressed Gas
Odor, Color, Grade:	COLORLESS GAS IN NORMAL USE. SWEET ODOR AT 500-750 PPM
Odor threshold	*No Data Available*
pH	7
Melting point	*Not Applicable*

Boiling Point	51 ºF
Flash Point	-4 ºF [*Test Method:* Tagliabue Closed Cup]
Evaporation rate	*Not Applicable*
Flammability (solid, gas)	Flammable Gas: Category 1.
Flammable Limits(LEL)	3 % volume
Flammable Limits(UEL)	100 % volume
Vapor Pressure	1094 mmHg [@ 20 ºC]
Vapor Density	1.5 [*Ref Std:* AIR=1]
Density	*Not Applicable*
Specific Gravity	0.87 [*Ref Std:* WATER=1] [*Details:* CONDITIONS: @ 20/20 C]
Solubility in Water	Complete
Solubility- non-water	*No Data Available*
Partition coefficient: n-octanol/ water	*No Data Available*
Autoignition temperature	804 ºF [*Details:* CONDITIONS: Burns in the absence of air]
Decomposition temperature	*Not Applicable*
Viscosity	*Not Applicable*
Volatile Organic Compounds	100 %
Percent volatile	100 %
VOC Less H2O & Exempt Solvents	100 %

SECTION 10: Stability and reactivity

10.1. Reactivity
This material is considered to be non reactive under normal use conditions.

10.2. Chemical stability
Stable.

10.3. Possibility of hazardous reactions
Hazardous polymerization may occur.

10.4. Conditions to avoid
Heat

10.5. Incompatible materials
None known.

10.6. Hazardous decomposition products

Substance	**Condition**
None known.	

Refer to section 5.2 for hazardous decomposition products during combustion.

SECTION 11: Toxicological information

The information below may not be consistent with the material classification in Section 2 if specific ingredient classifications are mandated by a competent authority. In addition, toxicological data on ingredients may not be reflected in the material classification and/or the signs and symptoms of exposure, because an ingredient may be present below the threshold for labeling, an ingredient may not be available for exposure, or the data may not be relevant to the material as a whole.

11.1. Information on Toxicological effects

Signs and Symptoms of Exposure

Based on test data and/or information on the components, this material may produce the following health effects:

Inhalation:
Toxic if inhaled.
Respiratory Tract Irritation: Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.

May cause target organ effects after inhalation.

Skin Contact:
Frostbite: Signs/symptoms may include intense pain, discoloration of skin, and tissue destruction.

Skin Irritation: Signs/symptoms may include localized redness, swelling, itching, dryness, cracking, blistering, and pain.

Eye Contact:
Frostbite: Signs/symptoms may include intense pain, clouding of the cornea, redness, swelling, and blindness.

Severe Eye Irritation: Signs/symptoms may include significant redness, swelling, pain, tearing, cloudy appearance of the cornea, and impaired vision.

Ingestion:
Gastrointestinal Irritation: Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Target Organ Effects:

Single exposure may cause:
Central Nervous System (CNS) Depression: Signs/symptoms may include headache, dizziness, drowsiness, incoordination, nausea, slowed reaction time, slurred speech, giddiness, and unconsciousness.

Respiratory Effects: Signs/symptoms may include cough, shortness of breath, chest tightness, wheezing, increased heart rate, bluish colored skin (cyanosis), sputum production, changes in lung function tests, and/or respiratory failure.

Prolonged or repeated exposure may cause:
Ocular Effects: Signs/symptoms may include blurred or significantly impaired vision.

Peripheral Neuropathy: Signs/symptoms may include tingling or numbness of the extremities, incoordination, weakness of the hands and feet, tremors and muscle atrophy.

Kidney/Bladder Effects: Signs/symptoms may include changes in urine production, abdominal or lower back pain, increased protein in urine, increased blood urea nitrogen (BUN), blood in urine, and painful urination.

Reproductive/Developmental Toxicity:
Contains a chemical or chemicals which can cause birth defects or other reproductive harm.

Genotoxicity:
Genotoxicity and Mutagenicity: May interact with genetic material and possibly alter gene expression.

Carcinogenicity:
Contains a chemical or chemicals which can cause cancer.

Ingredient	C.A.S. No.	Class Description	Regulation
ETHYLENE OXIDE	75-21-8	Cancer hazard	OSHA Carcinogens
ETHYLENE OXIDE	75-21-8	Grp. 1: Carcinogenic to humans	International Agency for Research on Cancer
ETHYLENE OXIDE	75-21-8	Known human carcinogen	National Toxicology Program Carcinogens

Toxicological Data
If a component is disclosed in section 3 but does not appear in a table below, either no data are available for that endpoint or the data are not sufficient for classification.

Acute Toxicity

Name	Route	Species	Value
Overall product	Inhalation-Gas(4 hr)		No data available; calculated ATE 973.3 ppm
ETHYLENE OXIDE	Inhalation-Gas (4 hours)	Rat	LC50 1,460 ppm
ETHYLENE OXIDE	Ingestion	Rat	LD50 330 mg/kg

ATE = acute toxicity estimate

Skin Corrosion/Irritation

Name	Species	Value
ETHYLENE OXIDE	Rabbit	Irritant

Serious Eye Damage/Irritation

Name	Species	Value
ETHYLENE OXIDE	official classification	Severe irritant

Skin Sensitization

Name	Species	Value
ETHYLENE OXIDE	Human and animal	Some positive data exist, but the data are not sufficient for classification

Respiratory Sensitization

Name	Species	Value
ETHYLENE OXIDE	Human	Some positive data exist, but the data are not sufficient for classification

Germ Cell Mutagenicity

Name	Route	Value
ETHYLENE OXIDE	In vivo	Mutagenic

Carcinogenicity

Name	Route	Species	Value
ETHYLENE OXIDE	Inhalation	Multiple animal species	Carcinogenic

Reproductive Toxicity

Reproductive and/or Developmental Effects

Name	Route	Value	Species	Test Result	Exposure Duration
ETHYLENE OXIDE	Inhalation	Some positive developmental data exist, but the data are not sufficient for classification	Rat	NOAEL 33 ppm	during organogenesis
ETHYLENE OXIDE	Inhalation	Toxic to female reproduction	Rat	NOAEL 33 ppm	1 generation
ETHYLENE OXIDE	Inhalation	Toxic to male reproduction	Monkey	LOAEL 50 ppm	2 years

Target Organ(s)

Specific Target Organ Toxicity - single exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
ETHYLENE OXIDE	Inhalation	respiratory system	Causes damage to organs	Human and animal	NOAEL Not available	
ETHYLENE OXIDE	Inhalation	central nervous system depression	May cause drowsiness or dizziness	Human	NOAEL Not available	
ETHYLENE OXIDE	Inhalation	respiratory irritation	May cause respiratory irritation		NOAEL Not available	

Specific Target Organ Toxicity - repeated exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
ETHYLENE OXIDE	Inhalation	peripheral nervous system	Causes damage to organs through prolonged or repeated exposure	Human and animal	NOAEL Not available	
ETHYLENE OXIDE	Inhalation	kidney and/or bladder	May cause damage to organs though prolonged or repeated exposure	Mouse	LOAEL 100 ppm	14 weeks
ETHYLENE OXIDE	Inhalation	eyes	May cause damage to organs though prolonged or repeated exposure	Human and animal	NOAEL Not available	
ETHYLENE OXIDE	Inhalation	respiratory system	Some positive data exist, but the data are not sufficient for classification	Mouse	LOAEL 200 ppm	14 weeks
ETHYLENE OXIDE	Inhalation	endocrine system	Some positive data exist, but the data are not sufficient for classification	Rat	NOAEL 100 ppm	2 years
ETHYLENE OXIDE	Inhalation	liver	Some positive data exist, but the data are not sufficient for classification	Multiple animal species	NOAEL 841 ppm	not available
ETHYLENE OXIDE	Inhalation	hematopoietic system	Some positive data exist, but the data are not sufficient for classification	Mouse	NOAEL 250 ppm	10 weeks
ETHYLENE OXIDE	Inhalation	immune system	Some positive data exist, but the data are not sufficient for classification	Mouse	LOAEL 200 ppm	14 weeks
ETHYLENE OXIDE	Inhalation	heart	All data are negative	Monkey	NOAEL 100 ppm	2 years

Aspiration Hazard

Name	Value

Please contact the address or phone number listed on the first page of the SDS for additional toxicological information on this material and/or its components.

SECTION 12: Ecological information

Ecotoxicological information

Test Organism	Test Type	Result
Water flea, Daphnia magna	48 hours	137 mg/l
Fathead Minnow, Pimephales promelas	96 hours	84 mg/l
Goldfish, Carassius auratus	24 hours	90 mg/l

Please contact the address or phone number listed on the first page of the SDS for additional ecotoxicological information on this material and/or its components.

Chemical fate information

Test Type	Result	Protocol
28 days Biological Oxygen Demand	107	
Log of Octanol/H2O part. coeff	-0.3	Est: Octanol-water part. coeff

Please contact the address or phone number listed on the first page of the SDS for additional chemical fate information on this material and/or its components.

SECTION 13: Disposal considerations

13.1. Disposal methods
Dispose of contents/ container in accordance with the local/regional/national/international regulations.

Dispose of waste product in a permitted industrial waste facility. The facility should be equipped to handle gaseous waste. Empty drums/barrels/containers used for transporting and handling hazardous chemicals (chemical substances/mixtures/preparations classified as Hazardous as per applicable regulations) shall be considered, stored, treated & disposed of as hazardous wastes unless otherwise defined by applicable waste regulations. Consult with the respective regulating authorities to determine the available treatment and disposal facilities.

EPA Hazardous Waste Number (RCRA): D001 (Ignitable)

SECTION 14: Transport Information

For Transport Information, please visit **http://3M.com/Transportinfo** or call 1-800-364-3577 or 651-737-6501.

SECTION 15: Regulatory information

15.1. US Federal Regulations
Contact 3M for more information.

311/312 Hazard Categories:

Fire Hazard - Yes Pressure Hazard - Yes Reactivity Hazard - Yes Immediate Hazard - Yes Delayed Hazard - Yes

Section 313 Toxic Chemicals subject to the reporting requirements of that section and 40 CFR part 372 (EPCRA):

Ingredient	C.A.S. No	% by Wt
ETHYLENE OXIDE	75-21-8	100

This chemical is a pesticide product registered by the United States Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS), and for workplace labels of non-pesticide chemicals. The hazard information required on the pesticide label is reproduced below. The pesticide label also includes other important information, including directions for use.
Do not swallow.
Causes skin and eye burns
May be fatal if inhaled in high concentrations

15.2. State Regulations
Contact 3M for more information.

15.3. Chemical Inventories
Contact 3M for more information.

15.4. International Regulations
Contact 3M for more information.

This SDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: Other information

NFPA Hazard Classification
Health: 3 **Flammability:** 4 **Instability:** 3 **Special Hazards:** None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

Document Group:	10-3495-8	**Version Number:**	55.00
Issue Date:	02/19/14	**Supercedes Date:**	11/22/13

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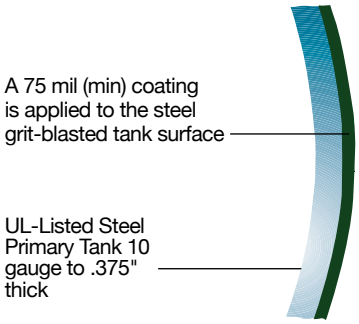
APPENDIX I: UST SPECIFICATIONS

HighGuard Underground Steel Storage Tanks

HT-1089

Superior Tanks for a Tough Environment

Highland Tank®



The HighGuard Tank features a strong dielectric coating of high solids polyurethane for protection, even under the most difficult conditions. HighGuard resists surface damage due to impact or abrasion that may occur during transportation, rigging and installation.

In fact, HighGuard underground storage tanks are so tough they require no cathodic protection or expensive corrosion monitoring. They out-perform fiberglass-reinforced polyester (FRP) clad tanks and do not require any artificial reinforcement.

HighGuard is superior in strength and rugged in appearance. After manufacturing and rigorous testing, the tank's exterior surfaces are commercially blasted with steel grit in preparation for coating.

The HighGuard protective coating is a dense, solvent-free, tar-free, two-component polyurethane coating system with high impact properties and tensile strength.

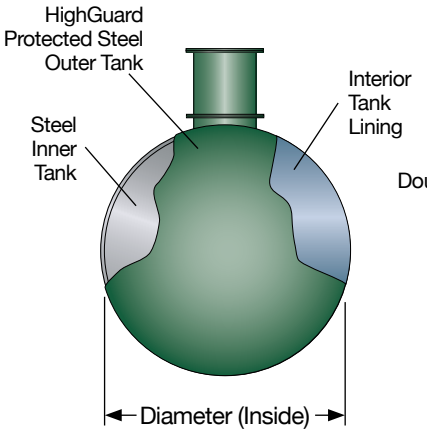
The coating is spray-applied with special equipment that ensures an even application of 75 mils over the entire surface of the tank.

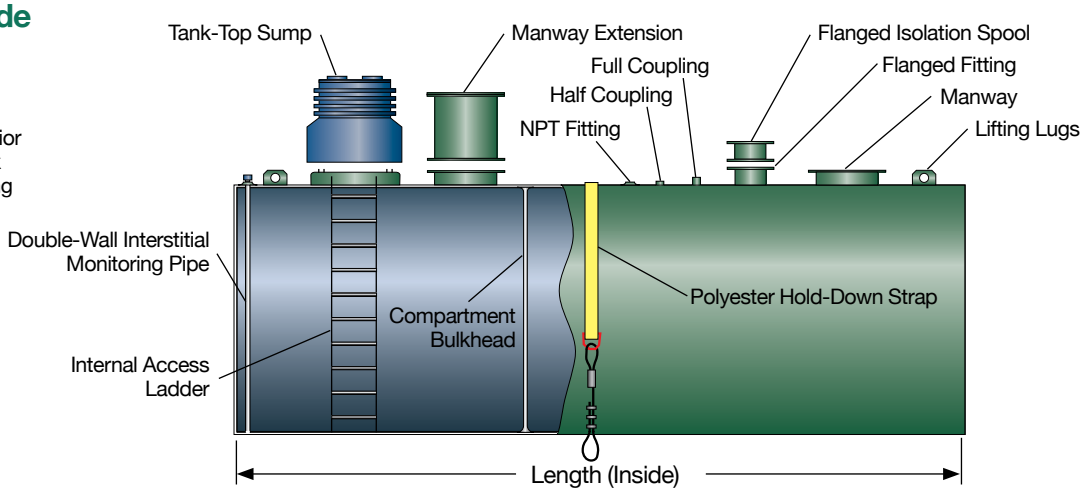
The finished tank is quality checked by a 15,000-volt spark test to ensure coating integrity and effective corrosion protection that can be measured in decades, rather than years.

Proudly Made In AMERICA

Unmatched Quality & Service

Horizontal Tank Sizing Guide





HighGuard Features

- UL-58 and UL-1746 compliant
- Provides 75 mils dielectric polyurethane protection
- Cured films are free of pores
- Must pass a 15,000 volt spark test before shipment
- Strong, flexible and resistant to impact, abrasion and corrosion
- No cathodic protection monitoring required
- Highland standard 10-year limited warranty
- Highland 30-year limited warranty is available

Flexible Designs

- Volumes from 240-50,000 gallons
- Custom sizes
- Multi-product storage compartments

Product Compatible

- Alternate fuel compatible without the additional cost of internal linings
- Safe storage for all motor fuels and biofuels, including biodiesel and ethanol blends

Environmentally Friendly

- Most environmentally-friendly coating on the market
- Uses no hazardous materials in production
- Can be disposed of as a non-hazardous material – steel tanks are 100% recyclable

Cost Effective

- On a total installed-cost basis, HighGuard's cost is less than any other unmonitored tank configuration on the market today
- No job site spark or air test required
- Lightweight construction for lower shipping and handling costs

Volume	Tank Dimensions	
Gallons	Diameter	Length
240	3'-2"	4'-0"
300	3'-2"	5'-0"
500	4'-0"	5'-5"
1,000	4'-0"	10'-9"
1,000	5'-4"	6'-0"
1,500	5'-4"	9'-0"
2,000	5'-4"	12'-0"
2,500	5'-4"	15'-0"
3,000	5'-4"	18'-0"
4,000	5'-4"	24'-0"
4,000	6'-0"	19'-0"
4,000	8'-0"	10'-8"
5,000	6'-0"	23'-10"
5,000	8'-0"	13'-4"
6,000	6'-0"	28'-8"
6,000	8'-0"	16'-0"
8,000	10'-0"	14'-0"
8,000	8'-0"	21'-4"
10,000	10'-0"	17'-0"
10,000	8'-0"	26'-8"
12,000	10'-0"	20'-6"
12,000	8'-0"	32'-0"
15,000	10'-0"	25'-6"
15,000	8'-0"	40'-0"
20,000	10'-0"	34'-0"
20,000	10'-6"	31'-0"
25,000	10'-0"	42'-6"
25,000	10'-6"	38'-9"
30,000	10'-0"	51'-2"
30,000	10'-6"	46'-6"
40,000	12'-0"	47'-6"
50,000	12'-0"	59'-6"

Please visit us at www.highlandtank.com

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Stoystown, PA 15563
P: 814-893-5701
F: 814-893-6126

4535 Elizabethtown Road
Manheim, PA 17545
P: 717-664-0600
F: 717-664-0617

958 19th Street
Watervliet, NY 12189
P: 518-273-0801
F: 518-273-1365

2700 Patterson Street
Greensboro, NC 27407
P: 336-218-0801
F: 336-218-1292

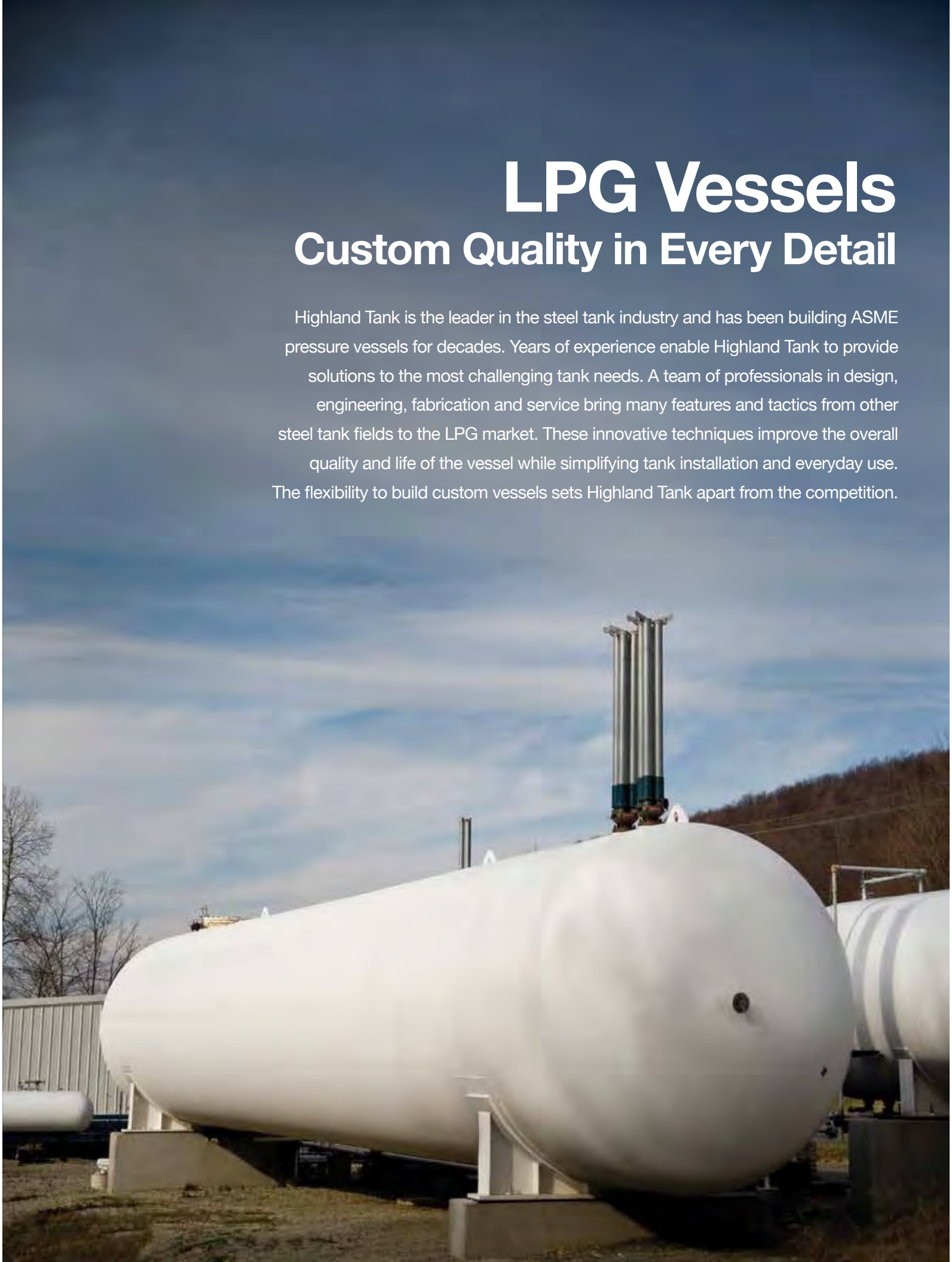
2225 Chestnut Street
Lebanon, PA 17042
P: 717-664-0602
F: 717-664-0631

1510 Stoystown Road
Friedens, PA 15541
P: 814-443-6800
F: 814-444-8662

LPG Vessels

Custom Quality in Every Detail

Highland Tank is the leader in the steel tank industry and has been building ASME pressure vessels for decades. Years of experience enable Highland Tank to provide solutions to the most challenging tank needs. A team of professionals in design, engineering, fabrication and service bring many features and tactics from other steel tank fields to the LPG market. These innovative techniques improve the overall quality and life of the vessel while simplifying tank installation and everyday use. The flexibility to build custom vessels sets Highland Tank apart from the competition.



LPG Vessels

Highland Tank's LPG vessels are designed and constructed to ASME, Section VIII, Division I and NFPA 58 "Liquefied Petroleum Gas Code" for stationary use vessels. Standard vessel sizes for industrial and commercial bulk uses range from 3,900 to 60,000 gallons. LPG vessels are constructed using SA516 Grade 70 steel, employing full-penetration butt welds on all seams. Highland Tank incorporates ASME 2:1 elliptical heads for their functionality and to maximize volume in a limited amount of space. Normal operating pressure is 250 psi at 125° F. Lifting lugs are standard to facilitate offloading and placement.

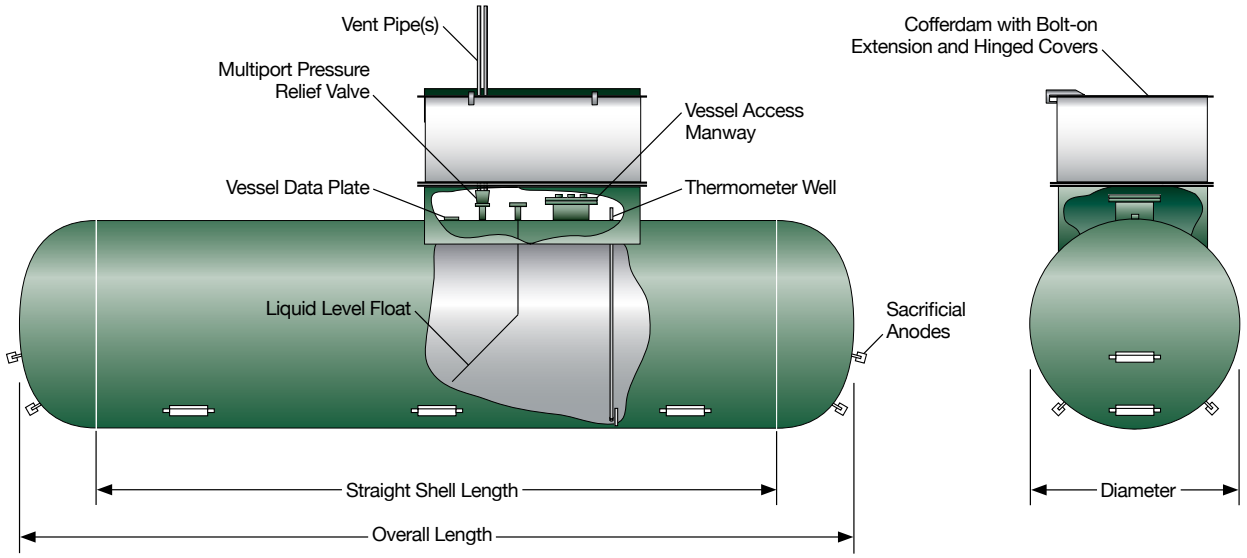
Large LPG storage vessels provide fuel for a wide range of industrial, commercial and agricultural industries including:

- Commercial and residential heating fuel
- Fleet vehicle fueling by school districts, government agencies and public transit companies
- Agricultural: crop drying, vehicle fuel and weed control
- Redundant fuel source for hospitals and other institutional, commercial and industrial properties
- Standby electric generators
- Distribution for consumers
- Autogas

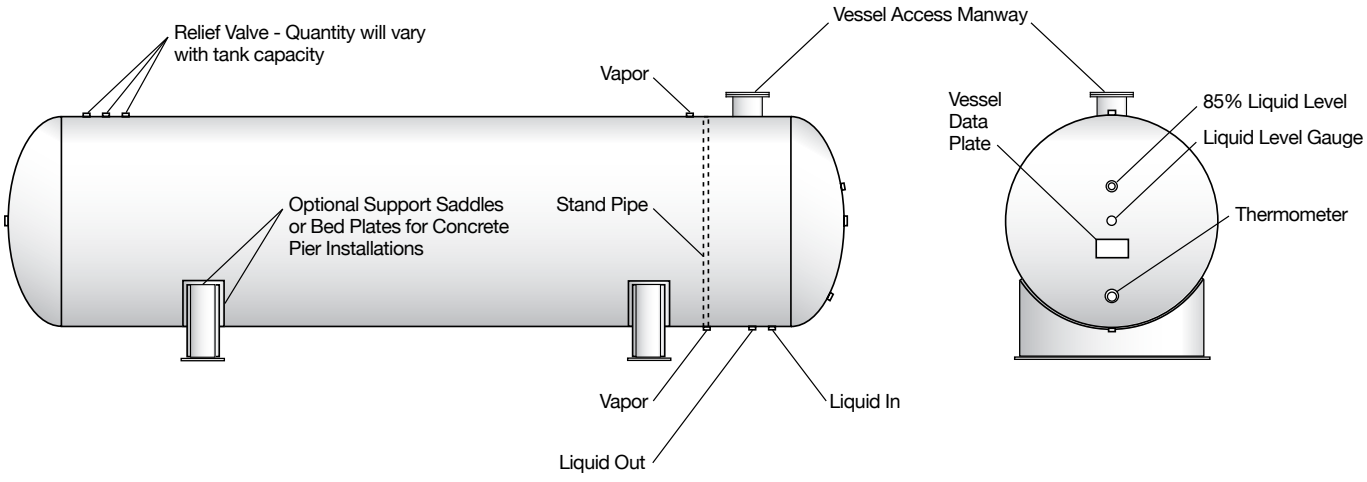
Standard Vessel Features

- Volume: 3,900 to 60,000 USWG
- ASME "U" Stamp
- 2:1 Elliptical heads – utilizes less space on property
- National Board Registration
- Test Pressure 325 PSI (250 PSI WP) at 125° F
- RT3 X-Ray Inspection
- Flanged manway
- SA516-70 high strength carbon steel
- Grounding connectors
- Grit blasted/coated with white urethane topcoat (aboveground)
- Grit blasted/coated with 75 mils of HighGuard coating (underground)
- External connections and outlets (valves or fittings not included)
- Lift Lugs
- Cofferdam work chamber for easy access (underground)

Underground



Aboveground



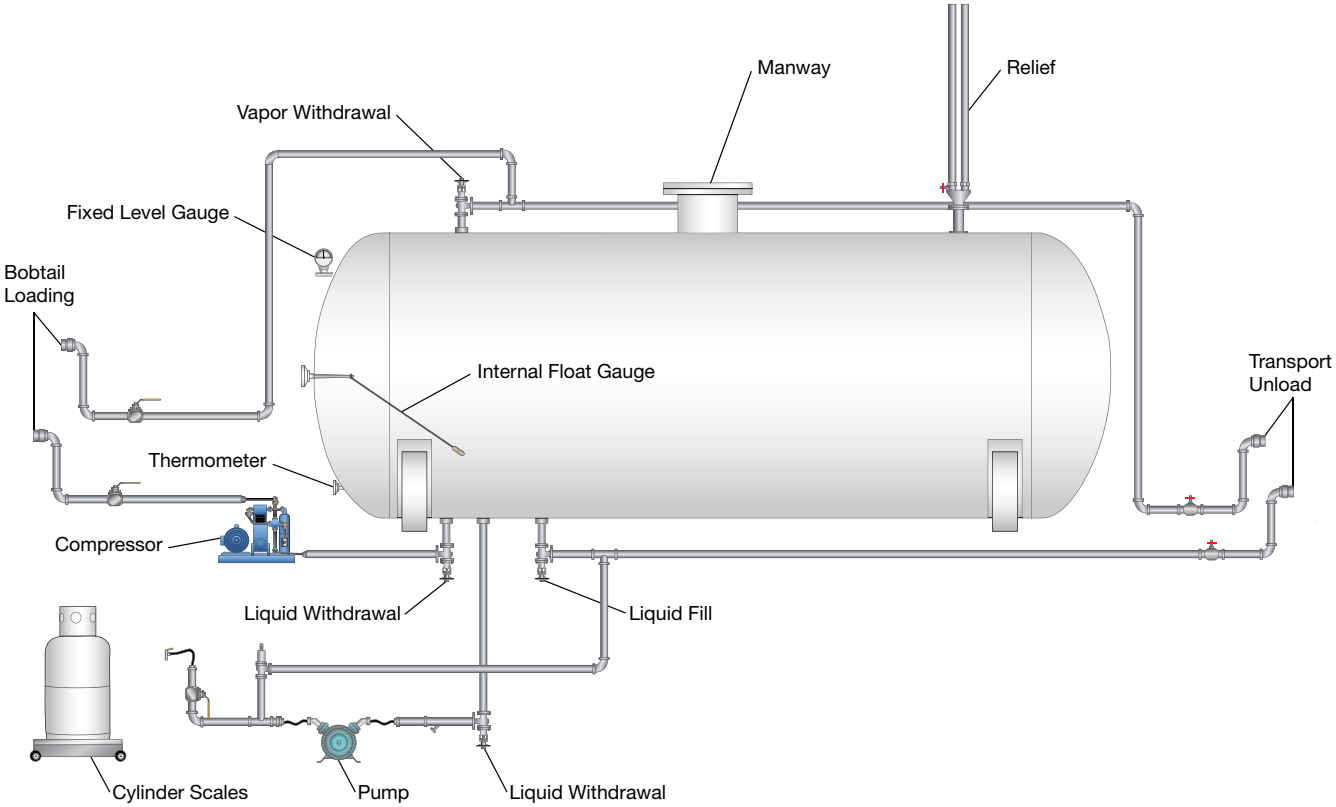
Standard openings are shown. Additional openings are available.

PROPANE EXCEPTIONAL ENERGY®

LPG Vessel Sizing Guide

Volume USWG	Diameter	Straight Shell Length	Overall Length
3,900	7'-0"	12'-4"	15'-2"
6,500	7'-0"	21'-17"	25'-5"
12,000	7'-0"	40'-6"	44'-4"
18,000	9'-1"	35'-6"	40'-5"
30,000	9'-1"	60'-3"	65'-2"
30,000	11'-0"	40'-4"	46'-2"
40,000	11'-0"	54'-5"	60'-3"
50,000	11'-0"	68'-5"	74’-3"
60,000	11'-0"	80'-6"	88'-10"

Custom sizes available



Bulk LPG Storage Vessel Applications

Bulk LPG vessels are used in several types of facilities. They store large amounts of propane to help a supplier meet the demand of the market in the area. Bulk facilities are used to distribute propane to residential and commercial consumers. Vessels are typically designed to load bobtails.

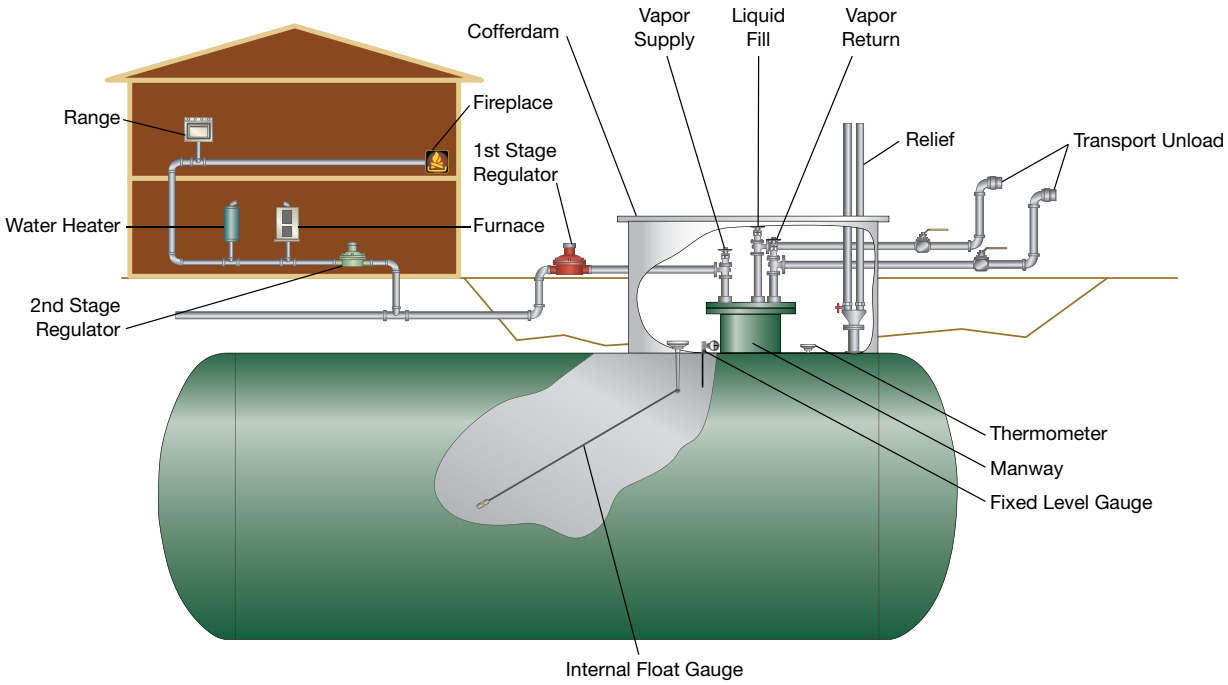
In many parts of the country, petroleum marketers are adding propane to their product mix. These facilities are installing aboveground or underground LPG vessels alongside atmospheric petroleum tanks.

In recent years, vast gas reserves trapped in the Marcellus Shale and other shale gas plays have been exploited. Naturally occurring hydrocarbons, known as NGL, are found in natural gas that is sourced from gas wells or associated with crude oil. These byproducts of natural gas have increased significantly with shale gas exploration and hydraulic fracing.

NGL products such as propane and butane are marketed to consumers. This has resulted in the development of new bulk facilities to store LPG.

In most cases, bulk plant facilities install aboveground vessels, but more facilities are moving to underground vessels each year.

Bulk plant LPG vessels are fitted with the appropriate fittings based on the application. Highland Tank has the flexibility to do custom manufacturing of LPG vessels. This can be an important factor in providing the perfect engineered solution for a customer.



Space Heating Fuel Supply LPG Vessel

More than one million commercial establishments use propane for heating and cooling air, heating water, cooking, refrigeration, drying clothes, barbecuing and lighting.

More than 350,000 industrial sites rely on it for space heating, brazing, soldering, cutting, heat treating, annealing, vulcanizing and many other uses. Petrochemical industries use propane to manufacture plastics.

Propane is also a staple on 660,000 farms where it is used in everything from grain drying to planting seeds, ripening fruit and running a variety of farm equipment such as irrigation pumps and standby generators.

Highland Tank will work with you to tailor our propane vessels to meet your specific design criteria.

Our ability to custom-fabricate propane vessels for almost any application is uncommon in the LPG industry.

Highland Tank's Exclusive State-of-the-Art Underground Vessel Technology

There are many good reasons to install propane vessels underground. Many facilities have limited real estate, and the space requirements for aboveground bulk storage vessels are prohibitive. Plus, underground LPG vessels provide added safety in the unlikely case of fire or other natural disaster.

Highland Tank's underground HighGuard vessels combine the structural strength of rugged steel construction with the lasting protection of our unique coating to produce a propane storage vessel second to none.

HighGuard features a strong dielectric coating of high solids polyurethane for protection, even under the most difficult conditions. HighGuard resists surface damage from impact or abrasion.

After manufacturing and rigorous testing, the vessel's exterior surfaces are commercially blasted with steel grit in preparation for coating. This process provides a superior coating adhesion. The protective coating is a dense, two-component polyurethane coating system with impact properties and tensile strength. Finished vessels have an even application of 75 mils over the entire surface of the tank.

Our Quality Control team then conducts a 15,000 volt spark test to ensure the coating integrity and guarantee effective corrosion protection.

Highland Tank is so confident in HighGuard that we stand behind it with a 10-year warranty – a warranty that is unique to the propane industry.

Highland Tank Raises the Bar in LPG Vessel Manufacturing

- Tradition of providing unmatched quality and service
- American made by skilled craftsmen
- State-of-the-art coatings
- Fabrication techniques that simplify installation & tank access
- Fixed pricing
- Timely delivery
- Turnkey solutions from engineering to manufacturing to installation
- Custom Fabrication

APPENDIX J: VAPORIZER SPECIFICATIONS

RANSOME
MANUFACTURING

Engineering and Equipment Manufacturing

RH Series Direct-Fired LP-Gas Vaporizers

Standard Features

- Mechanical liquid inlet valve provides positive control of LP-Gas liquid level on all RH 50, 80 and RH 120 sizes. Larger sizes use reliable float switch and electric inlet valve to prevent liquid carryover.
- Millivolt-powered gas control system maintains consistent vapor temperature under changing load conditions.
- Gas control valve is located inside the protective dry cabinet with the regulator mounted on the exterior providing for total ventilation.
- Precision operating temperature switch, factory-set and sealed against tampering, incorporates precious metal contacts for extended service life.
- Two-stage pressure regulation provides accurate burner gas burner pressures and performance regardless of changes in inlet pressure.
- ASME code vaporizing tubes with integral heat exchange vanes and insulated ducts provide efficient vaporization with minimum burner input.
- Modular design provides maximum capacity in a compact, rectangular unit.
- Double-Louvered combustion air baffles assure freedom from outages even during adverse weather conditions. (For extreme conditions, optional electric pilot reignitors are available).
- All sizes are capable of infinite turndown and will maintain a ready supply of vapor from zero load to full capacity. At no load, only enough heat will be generated to maintain vapor temperature and to prevent condensation.

Models are available in a complete range of sizes from 50 GPH to 1,000 GPH propane capacity, allowing you to buy precisely the vaporization you need.

Standard models are built to conform with requirements of National Fire Protection Association pamphlet 58, American Society of Mechanical Engineers Section VIII and California Code of Regulations Title 8. All models are Underwriters Laboratories, Factory Mutual System and Railroad Commission of Texas approved.

UL®

Factory Mutual System

brochureRH.CDR Revised: November 1994

Selection Chart

If your max. propane load requirements are up to *				Height		Width		Depth		Shipping Weight		RANSOME MODEL
GAL/HR	MILLIONS OF BTU/HR	CF/HR	KG/HR	IN.	CM.	IN.	CM.	IN.	CM.	LB.	KG.	
50	4.58	1823	96	31	79	16.5	42	20.5	52	205	92.8	**RH50**
80	7.32	2916	154	41	104	16.5	42	20.5	52	245	110.9	**RH80**
120	10.98	4374	231	48.5	123	16.5	42	20.5	52	285	129.1	**RH120**
200	18.30	7290	384	67.5	171	16.5	42	20.5	52	380	172.1	**RH200**
400	36.60	14580	768	69.5	177	28	71	26.25	67	920	416.7	**RH400**
600	54.90	21870	1152	69.5	177	42	107	26.25	67	1380	625.1	**RH600**
800	73.20	29160	1536	69.5	177	56	142	26.25	67	1840	833.5	**RH800**
1000	91.50	36450	1920	69.5	177	70	178	26.25	67	2300	1041.9	**RH1000**

(1) Units may be paralleled to achieve greater capacities. NOTE: For usage with other gases, consult factory for sizing information. (i.e. C3H6, NH3, SO2, C12)

Theory of Operation

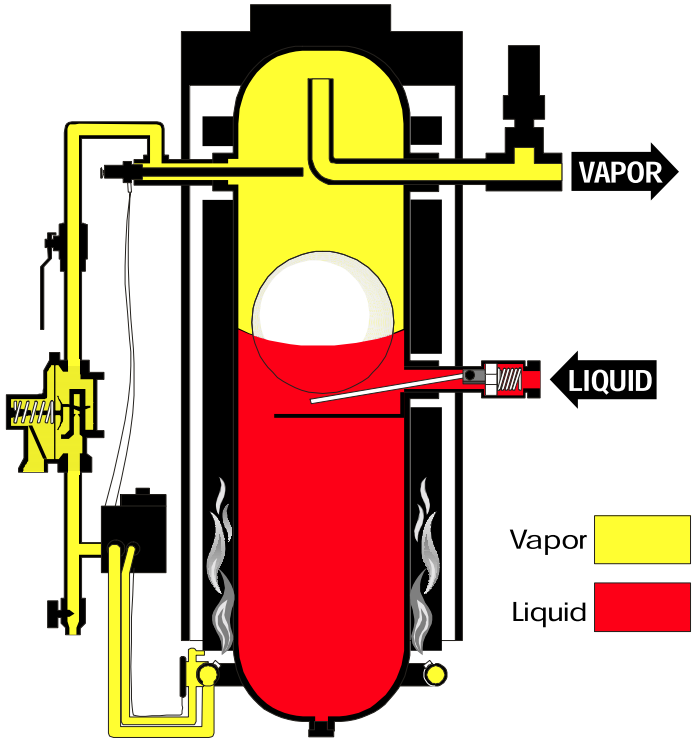
The RH Series vaporizer consists of a vertical ASME rated pressure vessel which is directly heated by a gas fired burner. The burner consumes a small portion of vapor from the vessel to develop the heat required for vaporization.

As liquid enters the vessel, it begins to vaporize as heat is absorbed from the warm heat exchanger. This causes the vapor temperature to decrease.

The operating temperature switch monitors vapor temperature and signals the gas control valve to fire the burner when vapor temperature drops below set point (120 degree F).

Ransome Models RH50 thru RH120 use a mechanical liquid level control system that consists of a mechanical inlet valve, which is actuated by a stainless steel ball located inside the vessel. If the liquid level rises above the desired level, the float will lift off the inlet valve lever allowing it to to close, preventing a liquid carryover. Once the level drops, the inlet valve will re-open.

Ransome Models RH200 thru RH1000 use an electrically operated liquid level control system which consists of an external float switch and solenoid valve. If the liquid rises above the desired level, the float will close the solenoid valve to prevent a liquid carryover.



RH Options

Option	Description	Add Suffix
Electric Pilot Reignitor	Protects against pilot outage due to unusually turbulent winds and eliminates need for matches to start vaporizer. 110v. required.	E

Warranty

Ransome Manufacturing, 3495 South Maple Avenue, Fresno, California, warrants to all parties all equipment manufactured and sold by it to be free from defects in material or workmanship under normal use and service, when installed and used in accordance with all applicable state and local codes, regulations and laws in accordance with National Fire Protection Pamphlet 58. Ransome Manufacturing agrees to repair or replace any equipment which its examination reveals to have been defective due to faulty workmanship or material, if returned to factory, transportation charges prepaid. Deviations from recommended applications, system design, installation and service practices, as well as deterioration or wear due to foreign materials or contamination present in LP-Gas or air shall be considered as abuses and render this warranty void.
This warranty applies for a period of one year from date of installation, but not more than eighteen months after shipment from factory.

This warranty is expressly in lieu of all other warranties expressed or implied, and of all obligations or liabilities on its part for damages including but not limited to consequential damages, following the use or misuse of equipment sold by it. No agent is authorized to assume any liability for Ransome Manufacturing, except as set forth above.

RANSOME MANUFACTURING

3495 South Maple Avenue • Fresno, California 93725 • USA
Telephone (559) 485-0979 • Fax (559) 485-8869

APPENDIX K: PROPERTY DEED

BK 5921 PGS 256 - 259
INSTR # 2012018369
10/31/2012 03:17:28 PM
HANCOCK COUNTY, ME

SHORT FORM QUITCLAIM DEED WITH COVENANT

LOWE'S HOME CENTERS, INC., a North Carolina corporation having a principal place of business in Wilkesboro, North Carolina ("Grantor"), for consideration paid, grants to **THE JACKSON LABORATORY**, a Maine nonprofit corporation with a mailing address of 600 Main Street, Bar Harbor, Maine ("Grantee"), with QUITCLAIM COVENANT, certain tracts or parcels of land, with any buildings and improvements thereon, situated in the City of Ellsworth, County of Hancock, and State of Maine, and being more particularly described on Exhibit A attached hereto and made a part hereof.

Being the same premises conveyed to the Grantor by virtue of a Warranty Deed from Beechland Corp. dated January 30, 2007 and recorded in the Hancock County Registry of Deeds in Book 4693, Page 318.

Said tract is subject to those retail use restrictions set forth in Exhibit B attached to this Deed, as well as any and all (i) any zoning, restrictions, prohibitions or other requirements imposed by governmental authority, (ii) the lien of ad valorem taxes for the current and subsequent years, and (iii) any exceptions, restrictions, conditions, easements, liens or other encumbrances of record or that would be disclosed by a current American Land Title Association survey of the land.

MAINE REAL ESTATE
TRANSFER TAX PAID

Grantor and Grantee expressly agree that the land is granted, sold and conveyed by Grantor and accepted by Grantee on an "AS IS" basis only. This conveyance is made subject to those items set forth on Exhibit A and Exhibit B attached hereto and incorporated herein. EXCEPT AS OTHERWISE SPECIFIED HEREIN, GRANTEE HEREBY ACKNOWLEDGES AND AGREES THAT GRANTEE SHALL RELY SOLELY UPON THE INSPECTION, EXAMINATION AND EVALUATION OF THE PROPERTY BY GRANTEE OR ITS REPRESENTATIVE(S). GRANTEE AGREES THAT IT IS PURCHASING THE PROPERTY FROM GRANTOR "AS IS", "WHERE IS" AND "WITH ALL FAULTS". FURTHER, GRANTEE EXPRESSLY ACKNOWLEDGES THAT EXCEPT AS OTHERWISE. SPECIFIED HEREIN, GRANTOR MAKES NO WARRANTY OR REPRESENTATION OF THE PROPERTY, EXPRESS, IMPLIED OR ARISING BY OPERATION OF LAW, INCLUDING BUT IN NO WAY LIMITED TO ANY WARRANTY OF CONDITION, HABITABILITY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IT IS FURTHER EXPRESSLY AGREED THAT GRANTOR DOES NOT MAKE ANY REPRESENTATIONS OR WARRANTIES, EXPRESS, IMPLIED OR ARISING BY OPERATION OF LAW, REGARDING SOLID WASTE AS DEFINED IN ANY APPLICABLE STATE REGULATIONS OR STATUTES, OR AS DEFINED IN THE U. S. ENVIRONMENTAL PROTECTION AGENCY REGULATIONS AT 40 C.F.R., PART 261, OR THE DISPOSAL OR EXISTENCE IN, ON OR EMANATING FROM THE PROPERTY, OF ANY HAZARDOUS SUBSTANCE, AS DEFINED BY THE COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT OF 1980, AS AMENDED, AND REGULATIONS PROMULGATED THEREUNDER.

This is not homestead property.

IN WITNESS WHEREOF, LOWE'S HOME CENTERS, INC. has caused this Instrument to be executed by Gary E. Wyatt, its Senior Vice President thereunto duly authorized this 26 day of October, 2012.

WITNESS:

LOWE'S HOME CENTERS, INC.

By: _____

Its: Gary E. Wyatt
Senior Vice President

STATE OF NORTH CAROLINA

October 26, 2012

COUNTY OF IREDELL

PERSONALLY APPEARED the above-named Gary E. Wyatt, Senior Vice President of LOWE'S HOME CENTERS, INC. and acknowledged the foregoing instrument to the his free act and deed in his said capacity and the free act and deed of said corporation.

Before me,

_____

Name: Crystal E. Whitley
Notary Public
Notary Commission Expires: 3-7-2014

CRYSTAL E. WHITLEY
Notary Public
Wilkes County, NC
My Commission Expires 3-7-2014

EXHIBIT A

All of that parcel of land in the City of Ellsworth, County of Hancock, State of Maine and more particularly described as follows:

Lot 2 as shown on the plan entitled "Amended Subdivision Plan of King Property Commercial Subdivision Kingsland Crossing (Hancock County) Ellsworth, Maine", dated December 12, 2006, prepared by Herrick & Salsbury, Inc., recorded in the Hancock County Registry of Deeds in Plan File 36, No. 46.

The herein conveyed premises are conveyed subject to an easement from Beechland Corp. to Acorn Associates LXIV, Ltd. dated May 6, 2005, recorded in Book 4190, Page 113 of the Hancock County, Maine, Registry of Deeds, as amended by an Agreement between Beechland Corp. and Darling's recorded in the Hancock County, Maine, Registry of Deeds in Book 4693, Page 292.

The premises hereinabove described as conveyed are (1) a portion of the "First Parcel" described as conveyed in a deed from Associated Builders, Inc. to Beechland Corp. dated Mary 1, 1991, recorded in the Hancock County Registry of Deeds in Book 1860, page 389; and (2) a portion of the premises described as conveyed in a deed from Nancy J. T. King to Beechland Corp. dated May 9, 2005, recorded in said Registry of Deeds in Book 4190, Page 190.

TOGETHER WITH all rights, easements, privileges and appurtenances belonging to the granted estate including without limitation, any and all signage rights and easements reserved and contained in that deed from Beechland Corp., a Maine corporation, to the City of Ellsworth, dated January 30, 2007, recorded with the Hancock County Registry of Deeds in Book 4693, Page 311, the appurtenant easement rights granted to Lowe's Home Center, Inc. by easement agreement dated February 2, 2007 and recorded in the Hancock County Registry of Deeds in Book 4693, Page 320, and rights under the Declaration of Covenants and Restrictions and Grant of Easement by Associated Builders, Inc. and Lowe's Home Center, Inc. dated April 25, 2007 and recorded in the Hancock County Registry of Deeds in Book 4753, Page 1.

EXHIBIT B

For a period of five (5) years from the date of this deed, Grantee, its successors and assigns, shall not use or permit the occupancy or use of any space upon the land for or in support of the purposes set forth herein and shall not use or permit the occupancy or use of any space upon any adjoining real property that makes use of the land for access, parking or as part of a larger unified development for the following entities:

(1) Home Depot

(2) Home Depot Expo

(3) Villagers Hardware

(4) Menard's, and

(5) stores operating under the Sears name (including, without limitation, Sears Hardware and Sears Home Appliance Showroom) or selling Sears branded goods (e.g. Craftsman, Kenmore),

Five (5) years from the date hereof, without any further release or evidence of satisfaction, this covenant and restriction shall expire and no longer encumber the above described property.

(4) P.45
Ret
Bernstein Shur
P O Box 5057
Augusta, Me
04332-5057

woodardcurran.com

COMMITMENT & INTEGRITY DRIVE RESULTS